DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR

SEPTEMBER, 1938 CIRCULATION OF THIS ISSUE — IN EXCESS OF 14,000 COPIES 25c

Its Popularity Is. Best Proof

OF THE VALUE OF THIS SERVICE!

Socony-Vacuum

Correct Lubrication

Protects more Diesels than any other Lubrication Service—because it offers operators the advantages of the GREATEST DIESEL LUBRICATION EXPERIENCE

IT'S THE REASON back of Socony-Vacuum's popularity that's important to you!

Socony-Vacuum has built its leadership in the Diesel field by passing on to its customers the benefits of the greatest Diesel experience in the oil industry!

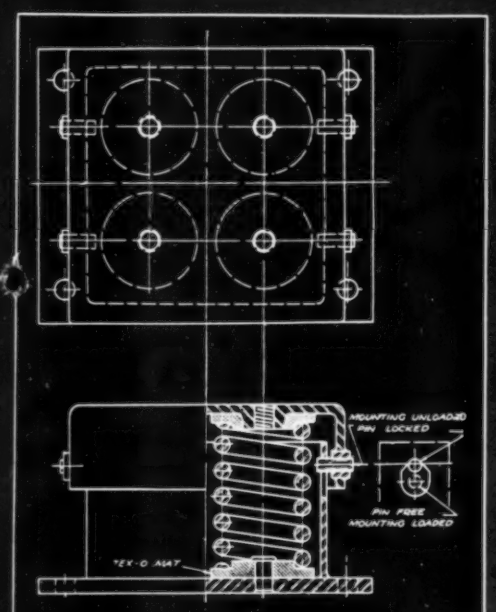
You get it in Gargoyle D.T.E. Oils! Socony-Vacuum has been refining Diesel oils longer than any other company; knows how to give them the resistance to deposit formation that *saves engine cleanings*... the stability that assures *minimum consumption*... the film strength that means *maximum protection.*

You get it in Socony-Vacuum's Engineering Service! A trained man is always ready to help you on special lubrication problems...to pass on to your men knowledge gained from his company's 38 years of lubricating Diesels!

Together, Gargoyle D.T.E. Oils and the Socony-Vacuum Engineer will help you get the *Correct Lubrication* that means more efficient and economical Diesel operation.

SOCONY-VACUUM OIL CO., Inc.

STANDARD OIL OF NEW YORK DIVISION · WHITE STAR DIVISION · LUBRITE DIVISION · MAGNOLIA PETROLEUM COMPANY
CHICAGO DIVISION · WHITE EAGLE DIVISION · WADHAMS OIL COMPANY · GENERAL PETROLEUM CORPORATION OF CALIFORNIA



Type U Hussman Unit Mounting
Load Range 3000/5000 Lbs.

WHY

HUSSMAN · SPRING · MOUNTINGS

PRODUCE EXCEPTIONAL RESULTS IN ELIMINATING VIBRATIONS

HUSSMAN • SPRING • MOUNTINGS are designed and built to fulfill all of the requirements essential for complete and permanent Isolation of Machinery Vibrations. They are:

1

ANALYSIS • INDIVIDUAL

All factors which determine the design and the application of the Mounting, such as weight of the machine, its speed, horsepower and center of gravity, its unbalanced forces and moments, the condition of the sub-structure, the nature of the soil, etc., all are carefully taken into consideration. Not a Stock Proposition, but an Individual Engineering Product, designed to suit the physical characteristics of the machine to be isolated, and the prevailing, general conditions.

2

SPRINGS • PROPERLY DESIGNED • CORRECTLY APPLIED

The Springs are designed for the lowest frequencies of the forced engine vibrations, with frequency ratios sufficiently high for maximum efficiency. The application is such that they are allowed full freedom to develop their elastic properties in all directions, without interference, without blocking, without lateral constraint, resulting in isolating efficiencies approaching 100 percent. The possibilities of fatigue, or breakage, are non-existing, by proper design of the spring and the selection of the proper material, with correct heat-treatment, so that safety factors are obtained which exceed by far the requirements of normal operation.

3

OPERATING AMPLITUDE • UNDER CONTROL

As stated, the springs are not harnessed by lateral constraint for the purpose of stabilization, a method which interferes with their natural function and reduces their efficiency as a vibration isolator. Control of the Amplitude of Motion of the running Engine is obtained by the • VISCO-STABILIZER •, a patented device which keeps the motion of the machine well within the limits allowed for safety and satisfactory operation, even during the periods of resonance, through which the engine must pass, in starting and stopping. This device is of particular value for marine applications, where additional provision must be made, to counteract the overturning moments of the set, while the ship pitches and rolls in a heavy sea, without impairing safety and reducing the isolating effect of the Mounting.

4

PERFORMANCE • PERMANENT

The absence of cork, felt, rubber, or any other material of the organic class, renders HUSSMAN • SPRING • MOUNTINGS immune against water, oil, or other influences. Welded-steel-construction, is used throughout, insuring great durability, and maximum strength, combined with minimum weight. Simple to install, as no adjustments are necessary, in the field.

Sold with the specific Guarantee, of your complete satisfaction.

CARL HUSSMAN

Specialist in solving vibration problems

120 SOUTH LA SALLE ST., CHICAGO, ILL.

COMPRESSION UPPED 10½ LBS. PER CYLINDER
...in 30 hours with RING-FREE!
...IN NORDBERG DIESELS

THE CITY OF NEODESHA
S. G. HAMILTON, CITY CLERK
PHONE 190
NEODESHA, KANSAS

June 28, 1938

Macmillan Petroleum Corporation
530 West 6th Street
Los Angeles, California

Attention: Mr. T. A. Hosey

Dear Sirs:

I wish to give you the facts regarding our trial operation with Ring-Free Lubricating Oil in our Type VE, 550-h.p. Nordberg Diesel Engine here in our plant.

Before putting Ring-Free into this engine, we took the compression and after thirty hours operation on Ring-Free we again took compression finding the same had increased an average of ten and one half pounds per cylinder.

We operated this engine on Ring-Free S.A.E. 30 for a total of 2020.5 hours, over a period of 247 days, and our consumption was only 139 gallons; giving 7994.7 h.p. hours per gallon.

On dismantling the engine, at the end of test period, I found it the cleanest of carbon and sludge of any diesel I have ever taken down. There was no measurable wear in cylinders with all rings and ports clean.

I have constructed and operated Diesel plants for over seventeen years; have had experience with various Diesel oils and like others have had the usual troubles with lubrication. But operations on Ring-Free have proven to me that it will save fuel, repair bills, and keep a Diesel properly operating much longer than other oils we have used.

Yours very truly,
Neodesha Municipal Water & Electric Plants

F. K. Vance

Superintendent

This is only one of hundreds of such letters, from operators of every type of diesel. Each reports increased compression and power . . . and reduced fuel consumption. The reason? Because, in comparative tests, RING-FREE'S greater film strength, heat resistance, faster penetration and "cling" reduce friction more than any other oil in America. Like Mr. Vance, many other diesel operators, using RING-FREE, report an end to sludge and carbon troubles . . and praise the fact that RING-FREE actually removes carbon formed by fuels and other oils. Moreover, RING-FREE does this grand lubricating job equally well in every type of diesel, gasoline and natural gas engine.

LET THE MACMILLAN MAN PROVE THESE RING-FREE QUALITIES TO YOU.

MACMILLAN
RING-FREE
MOTOR OIL

1. GREATER FILM STRENGTH
2. HIGHER HEAT RESISTANCE
3. LONGER CLING TO METAL
4. FASTER PENETRATION
5. REMOVES HARD CARBON
6. IS NOT CORROSIVE

MACMILLAN PETROLEUM CORPORATION
50 W. 50th Street, New York
624 S. Michigan Ave., Chicago
530 W. 6th Street, Los Angeles

WASTE SPACE TAKES IT

The new compactness and flexibility of the GM Diesel greatly extend the usefulness of the Diesel Electric Drive

TAKE almost any ship up to 9,000 deadweight tons and figure her available waste space.

Utilize these non-productive spots for the installation of a GM Diesel Electric Drive and you provide your vessel with a decided increase in cargo space.

For this new-type Diesel is designed on the GM 2-cycle principle, which eliminates excess weight and bulk—enables it to pack from 20% to 30% more power per cubic foot than marine Diesels of previous design.

In addition, it provides a flexibility of machinery arrangement never possible before. All of its standard accessories, for instance, may be placed on whichever side of the engine is more convenient. And, with the exception of length, every one of its important dimensions—base depth, support centers, total width and height—are identical for all size engines in the same series.

Thus, architects' and builders' problems are simplified still further.

When you consider such new developments as these, you can readily understand how the GM Diesel makes the operating advantages of the Diesel Electric Drive available to many vessels whose design limitations made its use impractical before.

Today, GM Diesel Power is suitable to all craft. Any ship you build, design or operate can be powered with General Motors Diesel engines. Why not write for further information to the address below?

For All Marine Uses GM DIESELS

- Single units—15 to 1200 horsepower
- Multiple units—any required capacity

GENERAL MOTORS

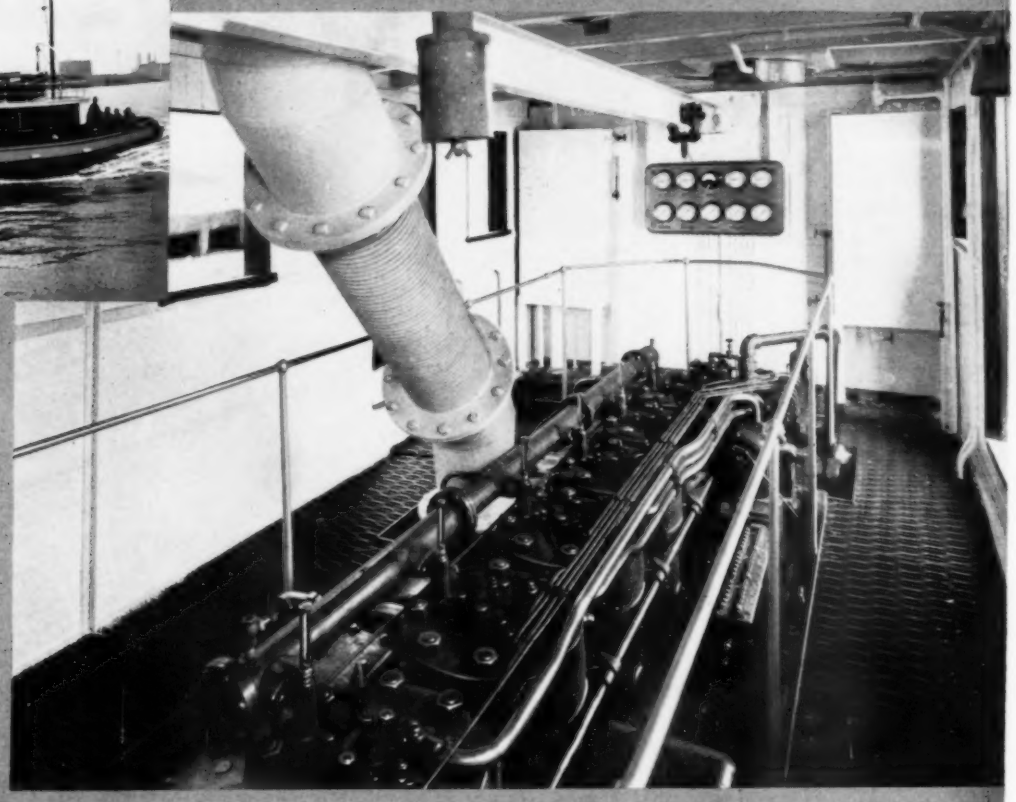
SALES CORPORATION

DIESEL ENGINE DIVISION • Cleveland, Ohio

GM DIESEL POWER

FORMERLY WINTON

F-M DIESEL CASE HISTORIES



TUG *Wm. P. Congdon* Changes from Steam to F-M Diesel Power!

● *The Wm. P. Congdon,* owned and operated by the Chesapeake Corporation of West Point, Virginia, has recently been reconditioned and dieselized with a 12" x 15" Model 37 F-M Diesel engine, which develops 450 hp. at 300 r.p.m., and a 10-hp. Model 36 F-M auxiliary unit.

This is another indication of the trend toward F-M Diesels by those who require economical, dependable service under difficult operating conditions. The simplicity of the F-M Diesel installation as compared with steam is apparent from a glance at the engine room pictured above. Ventilation is assured by an arrangement whereby scavenging air can be taken to the engine from the top deck or from the engine room.

Fairbanks-Morse Model 37 Diesels are two-cycle, direct-reversing, backflow pump-scavenging engines with oil-cooled pistons. The two-cycle principle eliminates both intake and exhaust valves and all complicated mechanism involved in their operation. Proof of the dependability of these engines is evidenced by their widespread acceptance in marine service where continuous trouble-free operation at full-rated capacity is essential.

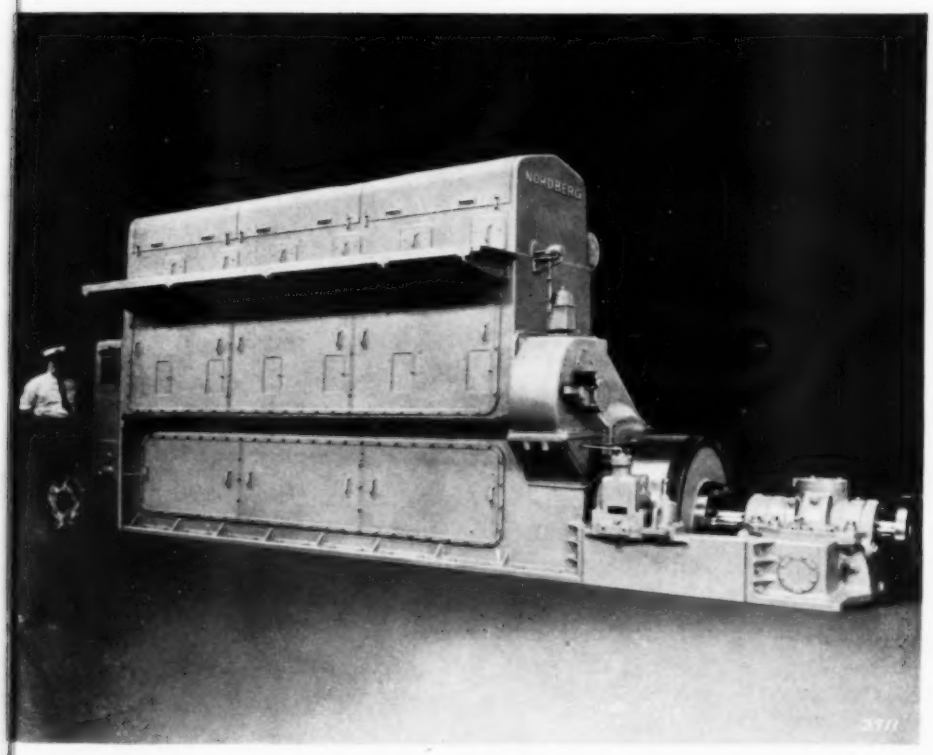
Regardless of the type of engine you need, Fairbanks-Morse builds it. You make no compromise that impairs efficiency. Write Fairbanks, Morse & Co., Dept. 23, 600 S. Michigan Ave., Chicago, Ill. Branches with service stations in principal ports.

3453-OA40.147

DIESEL PROGRESS for September, 1938. Volume IV. No. 9. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Possessions $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U. S. A., 50 cents for all other countries.

The "Traverse City Socony," built by the Manitowoc Shipbuilding Company for Socony-Vacuum Oil Company, powered with Nordberg Diesels.

SATCO* FILLS THE BILL



AFTER all is said and done, there is only one reason why Diesel engine makers use Satco lined bearings. That reason is: Satco fills the bill —gives the results expected of a good bearing alloy. And Satco gives satisfaction because it has (1) a low frictional coefficient, (2) adequate resistance to overload, (3) a relatively high melting and softening point, (4) the toughness to stand up under the severest operating conditions. These inherent qualities of Satco metal, plus the specialized skill employed in the production of Diesel bearings, insure proper fit, long wear and economical operation. We invite inquiries from makers and users of Diesels of all types in all fields of industry.

**A patented alloy manufactured by National Lead Company. Trade-mark registered.*

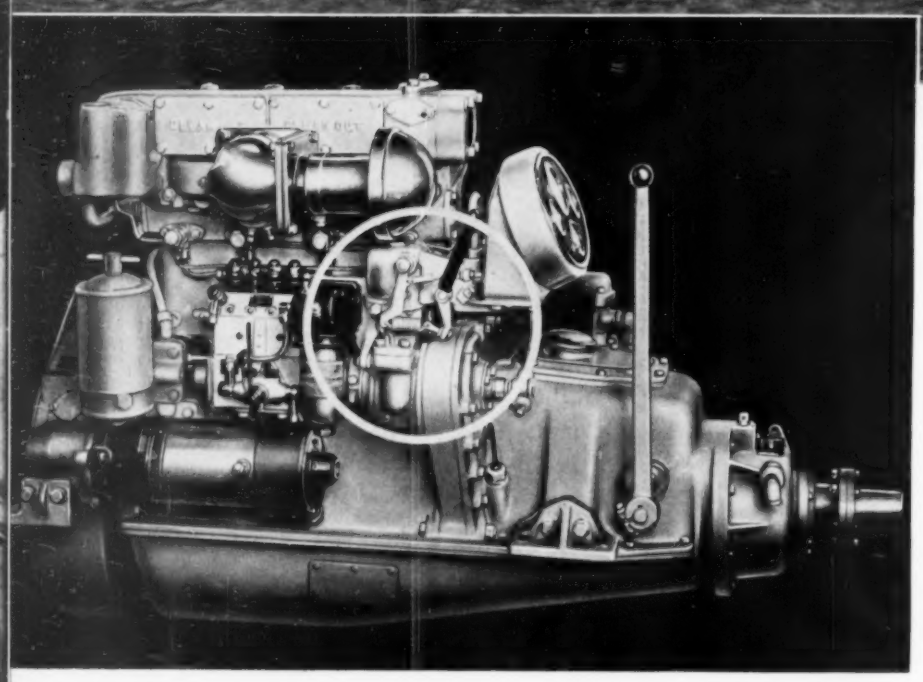
One of a pair of Nordberg Diesels used in the "Traverse City Socony." The engines are 6-cylinder, 750 hp., 4-cycle, direct-reversing, mechanical injection Diesels, operating at 300 rpm. The engines are equipped with Satco bearings.

AMERICAN BEARING CORPORATION

AFFILIATED WITH NATIONAL LEAD COMPANY

INDIANAPOLIS — INDIANA

CENTRIFUGAL American Bearing FORCE



PIERCE GOVERNORS

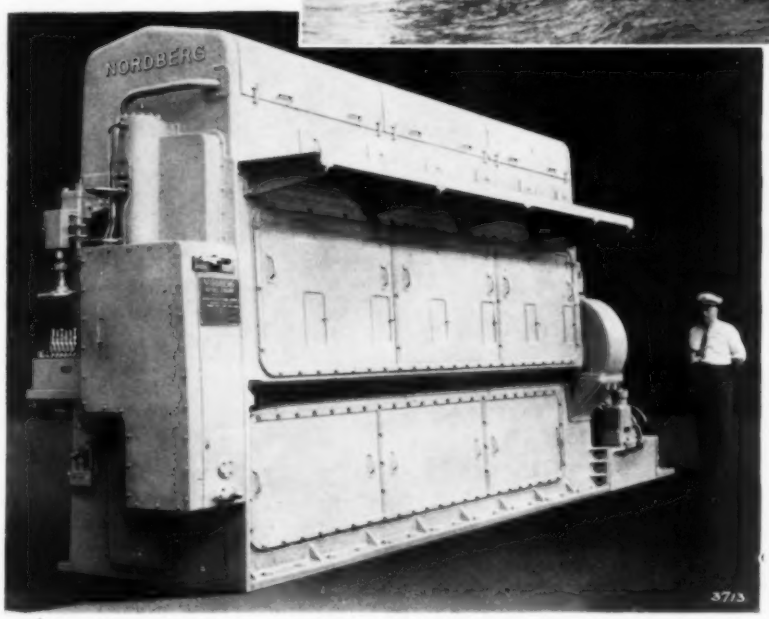
BUDA DIESELS . . .

installed in the *Porpoise* (see article on pages 36 and 37 this issue) are equipped with Pierce Governors, just as is the four cylinder BUDA illustrated above. Just another instance where performance counts. Just another example of the general trend amongst Diesel engine builders to standardize on Pierce Governors. Pierce Governors are designed to meet the particular requirements of each Diesel engine builder. Being of the centrifugal (flyball) type, they respond instantly to each change in engine load and maintain a uniform speed.

THE PIERCE GOVERNOR COMPANY
1600 OHIO AVENUE, ANDERSON, IND.

PIERCE GOVERNORS
STANDARD SINCE 1913

For Dependable Performance—Choose Pierce



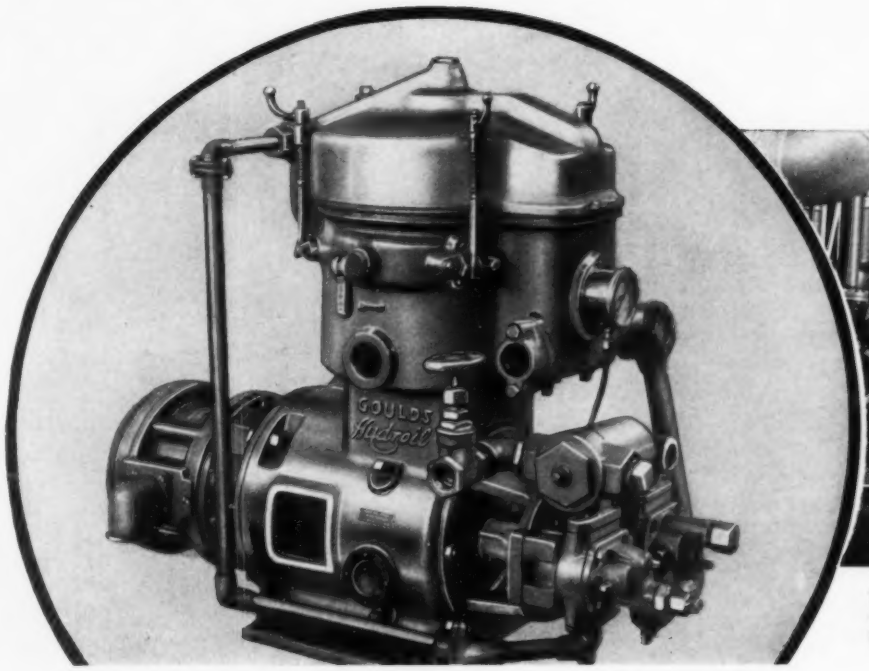
Dependability and long life, proved in innumerable marine and stationary installations, account for the repeated use of Erie equipment by leading engine builders.

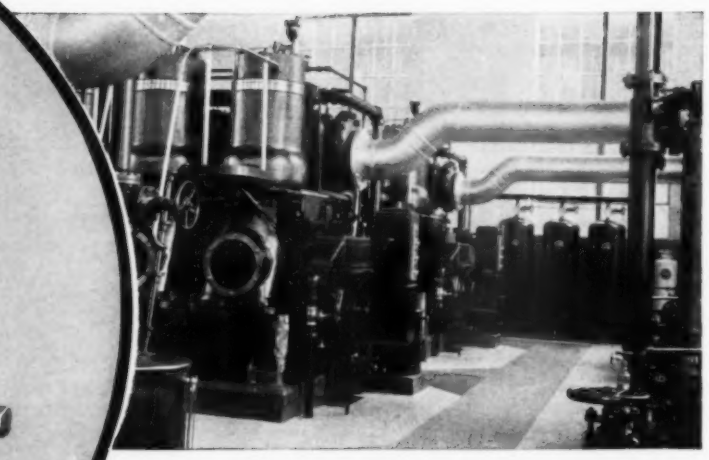
ERIE

Erie crankshafts were again specified by Nordberg Manufacturing Company for the two 750hp. Diesel engines installed in the "Traverse City Socony."

Rough and finished connecting rods, piston rods, crossheads, generator and extension shafts for all classes of stationary and marine engines. Complete facilities for prompt delivery on all major forged or cast steel elements required in the building and powering of every type of construction.

ERIE FORGE CO. ERIE, PENNSYLVANIA





This view of the general engine room of the Seaford Light & Power Co. shows three Fairbanks-Morse Diesels lubricated with oil cleaned by Goulds Hydroil Purifiers.

• • • IN THIS MODERN PLANT

GOULDS HYDROILS

ARE SERVING AND SAVING

THE SEAFORD LIGHT & POWER CO. recently built a new 600-kw. Diesel generating plant to serve the citizens of Seaford, Del.

Engineers designed this ultra-modern plant to give continuous, effective service to its customers. They knew that good lubrication is of vital importance in Diesel engine operation, so installed a Goulds Hydroil Centrifugal Oil Purifier.

Dirty lubricating oil is passed through a Goulds Hydroil and, after purification, returned to the engine's clean oil reservoirs. This is another instance where Diesel operators have learned the importance of cleaning oil to reduce engine wear.

Other plants can also obtain these same advantages from a Goulds Hydroil. Our Engineers are always available for consultation on your oil purification problems. Write today for complete information.

Another Goulds aid to Diesel operating economy—the new Goulds Exhaust Gas Heater. Without any operating cost, it preheats oil for centrifuging. Cold oils and highly viscous oils are quickly and economically heated for efficient centrifuging by utilizing B.T.U.'s otherwise wasted. It does away with the need for current consuming electric heaters, requires little attention, controls the temperature automatically or manually. Let us send you Bulletin No. 510 on the Goulds Exhaust Gas Heater.

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DIESEL ENGINES

NINETY SEVEN DIFFERENT MODELS

Ninety-seven Diesel Engines

Described in Detail by . . . **B. J. VON BONGART**
Aviation Section by . . . **PAUL H. WILKINSON**
288 Pages — 10¼″ x 13½″ — 704 Illustrations

$3.00

THE DIESEL ENGINE CATALOG

THIS new book on Diesel engines is entirely different from any other book published on the subject. In this new book ninety-seven Diesel engines are described in detail, illustrated in color and in full section.

B. J. Von Bongart, author of the new book "Diesel Engines," and technical editor of DIESEL PROGRESS, one of the most experienced and best known engineers in the Diesel industry, has described in intimate detail these ninety-seven Diesel engines. In this book he goes into the matter of individual design, discusses the features of design of each engine in clear cut, thoroughly understandable manner and makes it possible for the reader to grasp readily and quickly the difference between the various makes and types of engines now available on the market. He makes it possible to select from these ninety-seven different models the one engine fitted to the job in mind.

Beautifully illustrated in color, with sectional drawings visualizing with complete clarity the design features of each engine, this new book brings you under one cover a marvelously clear picture of the engines now available. Right up to the minute, as modern as tomorrow, printed on a big page size (10¼″ x 13½″) to make the illustrations readable, this new book is indispensable to the Consulting Engineer, Diesel Salesman, prospective Diesel engine buyer—yet the price is but $3.00 postpaid.

We offer you this new book, believing it to be the finest book of its type ever produced, authoritative, informative, beautifully printed and bound—a book you will be proud to own, a book from which you will obtain much useful information. May we hope you will use the coupon hereunder today—now?

Diesel Engines Described

- Alco Four Cycle Stationary
- Alco Locomotive Type
- Alco-Sulzer Types "T" and "TM"
- Alfa Romeo 2-cycle Automotive Engines
- Allis-Chalmers Oil Engines
- Atlas Imperial Stationary and Marine Diesels
- Ball-Muncie Vertical and Horizontal Engines
- Bristol "Phoenix" Diesel
- Buckeye Heavy Duty Type Diesel
- Buda-Lanova Automotive and Marine Diesels
- Busch-Sulzer Bros. 2-cycle
- Busch-Sulzer Bros. 4-cycle
- Caterpillar Industrial Engines
- Caterpillar Marine Engines
- Chicago Pneumatic Model 8-CP
- Chicago Pneumatic Type RHB
- Chicago Pneumatic Type RHB-100
- Clerget Aviation Diesel
- Coatalen Aviation Diesel
- Cooper-Bessemer Type EN
- Cooper-Bessemer Type GN
- Cooper-Bessemer Type JTB
- Covic Industrial, Marine and Automotive Diesels
- Cummins
- De La Vergne Type VA
- De La Vergne Model VB
- De La Vergne Model VE
- De La Vergne Model VG
- De La Vergne Model VM
- De La Vergne Model VO
- Deschamps Aircraft Diesel
- Deutz Diesel Engines
- Diesel Marine Auxiliary Units
- Enterprise Marine and Stationary Types
- Fairbanks-Morse, Types 33 and 37
- Fairbanks-Morse, Model 36-A
- Fairbanks-Morse Model 36-A-8
- Fairbanks-Morse Model 42-E
- Fairbanks-Morse Models 32 and 35
- General Motors Model 71 2-cycle Engines
- General Motors Model 567 2-cycle Engines
- Gray Marine Diesels
- Guiberson Aviation Diesel
- Hall-Scott "Chieftain"
- Hamilton-M.A.N. Double Acting Engines
- Hercules Automotive Diesels
- Hill Diesels Models A, B, and C
- Ingersoll Rand Type "S"
- International Harvester — Four and Six Cylinder Types
- Junkers Jumo 205 Diesel
- Kahlenberg Marine and Stationary Engines
- B. M. W. Lanova Aviation Diesel
- Lister Small Stationary Diesels
- Lorimer Slow-Speed Heavy-Duty Diesels
- Murphy MD Series
- Napier Culverin Diesel
- Nordberg 4-cycle
- Nordberg 2-cycle
- Northeastern Diesel Engines
- Power Manufacturing Company
- Ruston-Hornsby—Horizontals
- Sterling Crankless Diesel Engines
- Stover Single Cylinder Diesel
- Superior Model "A"
- Superior Model "D"
- Superior Type M
- Superior Type S
- Thornburg High-Speed Diesel Engines
- Venn-Severin Model "D" Type "M"
- Victor Horizontal Type
- Waukesha—Hesselman Type
- Waukesha—Comet Diesel
- Weber Horizontal Engines
- Weber Vertical Engines
- Western—Type DS
- Witte Horizontal and Vertical Types
- Worthington Four-Cycle Diesel Engines
- Z. O. D. Aviation Diesel

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Address_____

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please print name and address

INTERNATIONAL Diesel Saves $20.60 a Day Making Barrel Staves

This is the International PD-80 Diesel Power Unit installed in the barrel stave mill owned by Williamson and Raines at Murphysboro, Ill.

TYPICAL of the variety of jobs International Diesel Power Units power at low cost is the barrel stave mill operated by Williamson and Raines at Murphysboro, Ill. Turning out about 1,000 board feet of staves in a 10-hour day, the International PD-80 Diesel operates for only $3.40 a day for fuel and oil, compared to $24 a day run up by the steam engine formerly used—a saving of $20.60 every 10 hours by this International.

Owners in many industries report that these compact, efficient units give them maximum performance for every power dollar invested. This is language that every business man understands, whether he uses power to operate a small factory in a city, a sawmill in an out-of-the-way place, or an irrigation pump.

When costs pinch profits in your business, look to your power. Ask the nearby International industrial power dealer or Company-owned branch to analyze your problem and show you how International Diesel power will reduce your operating costs. International Diesel engines are also available in International wheel and crawler tractors.

Write us for information

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
180 North Michigan Avenue Chicago, Illinois

INTERNATIONAL Industrial Power

WRITE YOUR OWN PRESCRIPTION

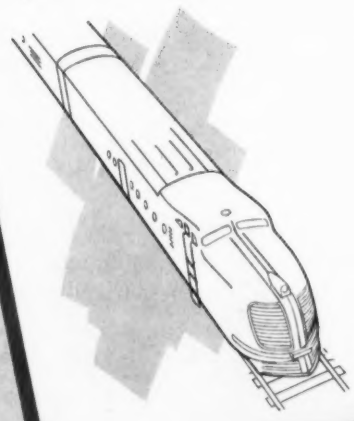
as

these men did

Rx Reduce Deadweight of Truck Engine

A builder of Diesel engines for powering transport trucks had to reduce the weight of those engines. To do this, he took advantage of the weight-saving ability of Alcoa Aluminum Alloys.

Rx Cut Weight of Streamliner's Engines



The engines driving these trains had to be compact and light in weight. Aluminum in the pistons, blower housings and many other parts gave able assistance in solving this problem.

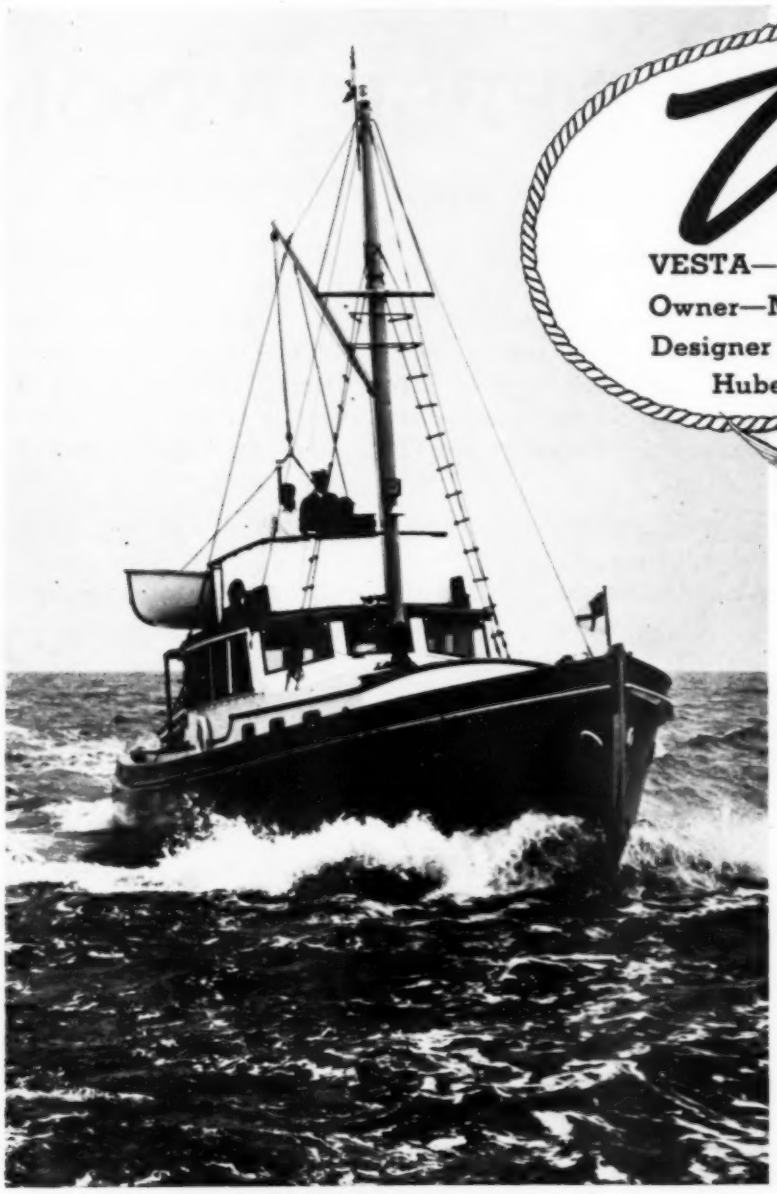
THEIR PROBLEM was to save weight and conserve space. Alloys of Alcoa Aluminum provided the solution.

The superior heat conductivity of Aluminum pistons and cylinder heads, and the lighter weight of these pistons, make it possible to increase considerably the horsepower ratings of Diesel engines. As a result, Diesel engines employing Aluminum for these parts are more compact and lighter in weight than those of equal horsepower, not so equipped.

You'll find that Aluminum offers the most economical means of reducing weight; for cylinders, frames, bedplates and other structural parts. High standards for reliability are maintained.

Aluminum Company of America, 2141 Gulf Bldg., Pittsburgh, Pennsylvania.

ALCOA · ALUMINUM



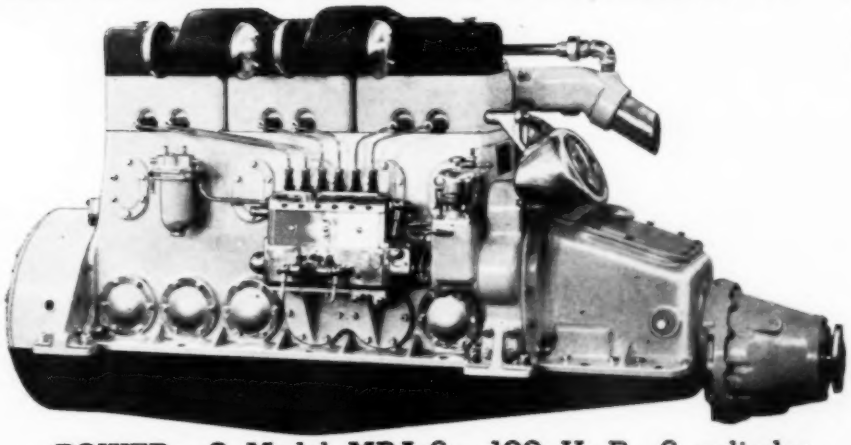
Vesta

VESTA—48′ Twin Screw off shore Fishing Cruiser.
Owner—Mr. H. C. Gibson, Jenkintown, Pa.
Designer and Builder—
Hubert S. Johnson, Bay Head, N. J.

REPRESENTING the realization of a dream of long standing, VESTA has more than proved to her owner that dream ships can come true given the best in skilled workmanship and materials of the finest quality.

From keel to comfortable lookout seat and from stem to stern transom not a detail was overlooked that would contribute to the owner's comfort, convenience and safety on long offshore trips in search of the big fellows that make headline news.

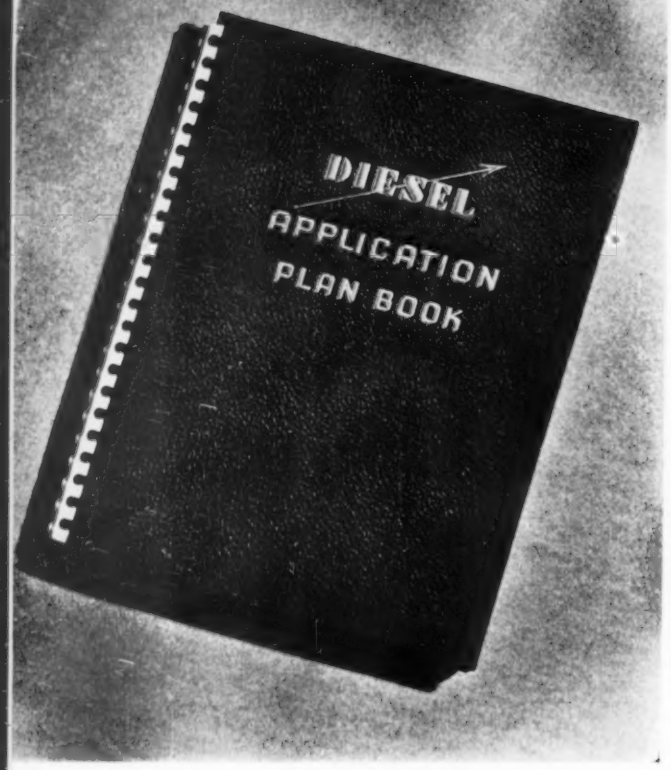
The Superior Diesel, with its well earned reputation for trustworthy service was a natural choice for this boat. Mounted on rubber, cooled by fresh water, vacuum controlled and completely sound proofed this most modern of Diesel installations is creating widespread interest among both yachtsmen and fishermen along the Atlantic Seaboard.



POWER—2 Model MRA-6—100 H. P., 6 cylinder SUPERIOR DIESELS with reduction gears.

Superior DIESELS

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
FACTORIES: Springfield, Ohio; Philadelphia, Pa. SALES OFFICES:



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Edited by JOHN W. ANDERSON

300 Pages • 9″ x 12″ • 511 Illustrations

A New Book on Diesel Applications. Three Hundred Pages of Plans Depicting Hundreds of Successful Diesel Applications—A Remarkable Book in Which Has Been Gathered Together the Experience, the Know-how of an Entire Industry. Each Plan Described in Detail. The Problems Met and Solved Fully Described.

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Address _____

_____

12 Please print name and address

Mack sells Colonial Sand and Stone Company, Inc., of New York City

50 new Mack Trucks powered by *Cummins Diesels*

for New York City operation where the average daily runs are only 35 miles.

Colonial purchased *62* additional Cummins Diesels to replace their old gasoline engines. They now own a total of... *112*

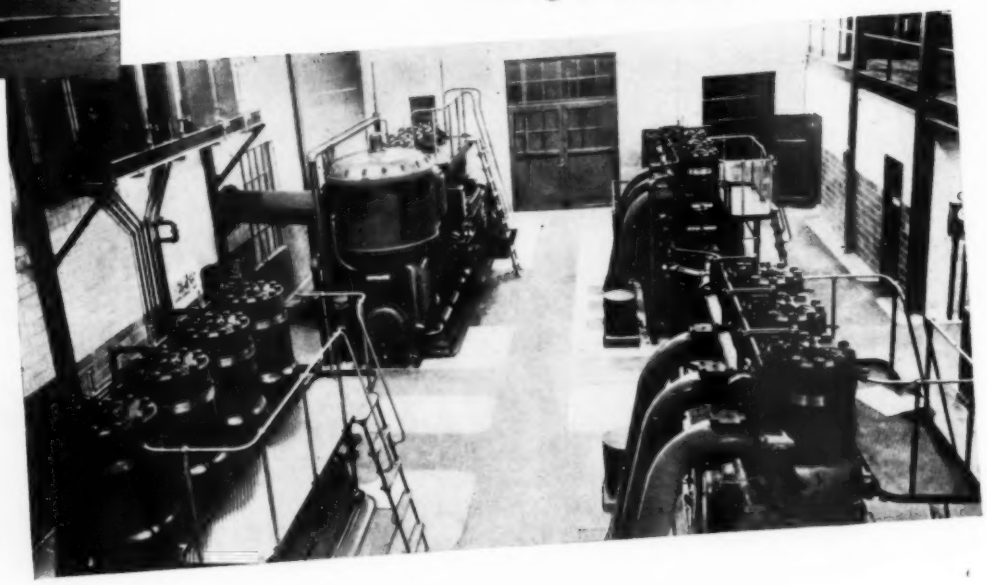
CUMMINS ENGINE CO., COLUMBUS, INDIANA

CUMMINS
Dependable
DIESEL
PIONEER IN MODERN DIESEL DEVELOPMENT

"No Evidence of PISTON OR CYLINDER WEAR"

Says Supt. Watts of 1450 h.p. Corning Power Plant

Outside view of Diesel power house and pumping station at Corning, Iowa. Its four Fairbanks-Morse 2-cycle Diesels have been lubricated with Texaco Algol Oil.



Corning, Iowa, Diesel plant, consisting of two 225 h.p. 14 x 17 F-M engines, one 300 h.p. 14 x 17 F-M engine, and the recently added 700 h.p. F-M engine with scavenging pump. There have been no service interruptions due to lubrication. Texaco Algol Oil has been used from the first.

THIS CORNING POWER PLANT has received national recognition for general operating economy and efficiency.

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Not one interruption to service has occurred that can in any way be traced to lubrication.

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Performance like this shows why *more stationary Diesel h.p. in the United States is lubricated with Texaco than with any other brand.* You can get this same excellent service from *your* Diesels by adopting Texaco.

2108 warehouse plants throughout the United States assure prompt delivery, wherever you are. Phone your nearest Texaco warehouse plant, or write:

The Texas Company, 135 East 42nd Street, N. Y. C.

"Pistons on the three smaller units have been pulled only once since 1935. There was no evidence of wear, and there had been no hot spots. We have used Texaco Algol in all units since 1935."—BRUCE B. WATTS

Bruce B. Watts

Texaco's latest booklet *for Diesel operators. 80 pages of charts, diagrams, phantom drawings, text. Every operator should have a copy. Free for the asking.*

TEXACO

Algol AND *Ursa* OIL

FOR DIESELS

REX W. WADMAN
Editor and Publisher

FRONT COVER ILLUSTRATION: Bow view of *Traverse City Socony*, new 290 ft. Great Lakes Tanker, described in detail on pages 18 to 23.

TABLE OF CONTENTS ILLUSTRATION: Tully & Di Napoli, Inc., contractors assigned to some big earth moving jobs on the new New York World's Fairgrounds, have turned to Diesel engines to speed along their share of the project. Two Northwest Draglines in foreground are Caterpillar-powered.

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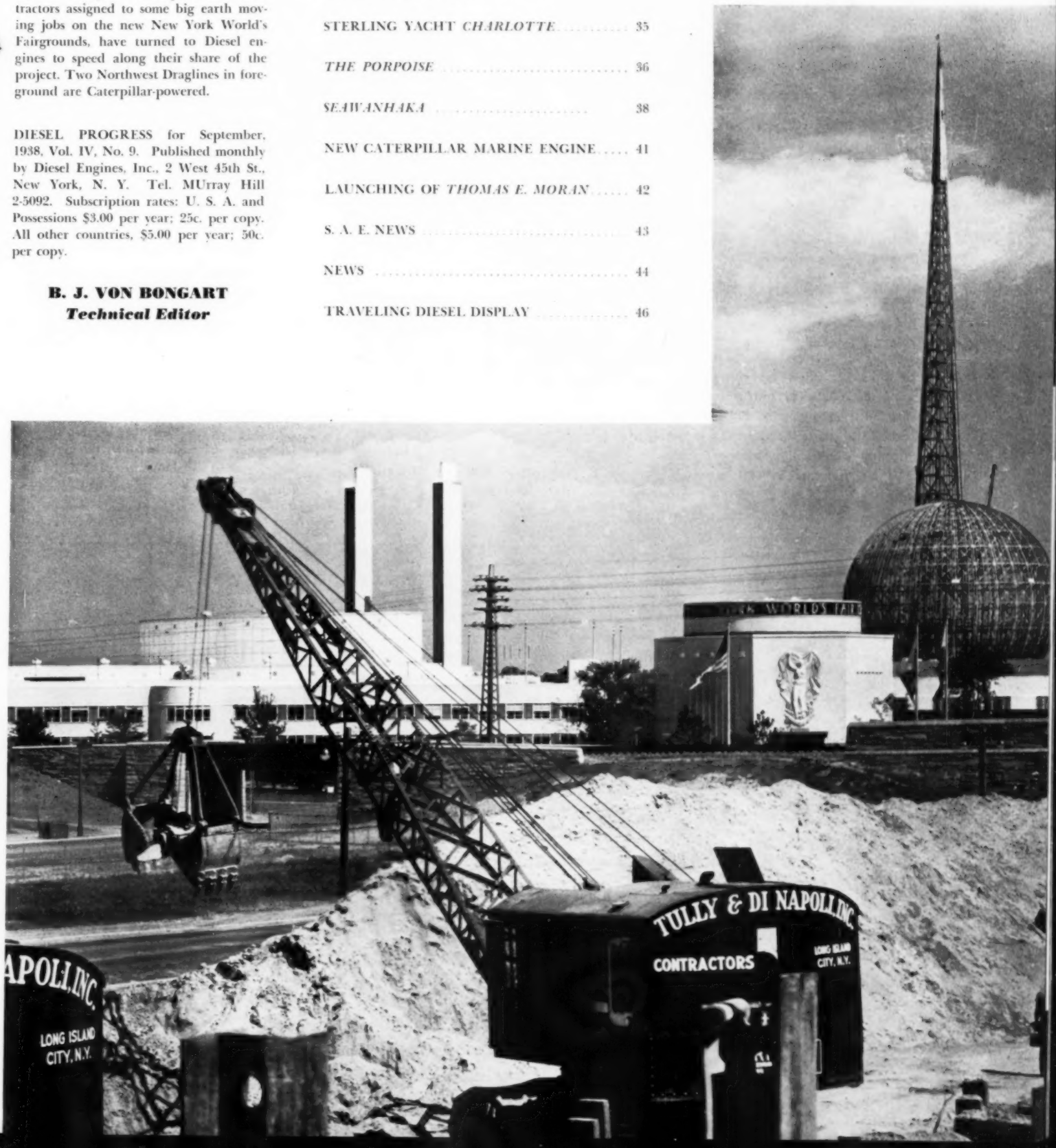
B. J. VON BONGART
Technical Editor

CONTENTS
SEPTEMBER



THE "REBEL III"

By B. J. VON BONGART

THE *Rebel* Diesel-engined streamline trains of the Gulf, Mobile & Northern Railroad have made history on the 488 mile run between Jackson, Tenn., and New Orleans, La. These streamline trains consist of a power car with mail and baggage compartments and two coaches seating 71 and 62 passengers, respectively. The first two *Rebels* were put into service in 1935 and their performance has been signally satisfactory. To augment its program, the G. M. & N. Railroad has put into service the third *Rebel* embodying the latest features in modern railroading.

The *Rebel III* is a streamline train following the same general design and contour of the two original Rebels. This train was constructed at the Berwick, Pa., plant of the American Car & Foundry Company. It is a three car train, consisting of a power car incorporating the usual mail and baggage compartments and two combination day and sleeping coaches, the latter divided into four compartments. The front compartment of the coaches has a seating capacity for 12 passengers with separate toilet facilities and is set aside for colored travelers. The adjacent compartment, seating eight passengers, may be used for either white or colored travelers, as occasion would demand.

Now follows the third compartment with seating facilities for 20 white passengers, which, however, is separated from the second compartment intended for either white or colored passengers, by a vestibule. Directly following the third compartment is the sleeper section consisting of six units. Each features full sized reclining back seats for day use, and commodious berths for night travel.

Directly adjacent to the sleeping compartment are the men's and women's dressing rooms. These are fitted in the modern manner and style, porcelain wash basins and full-length door mirrors. The ladies' dressing room is fitted with a vanity table and large illuminated mirrors.

The entire train is air-conditioned with the A.C.F. system, consisting of a York six-ton compressor and an A.C.F. fan-cooled condenser unit, both are mounted beneath the car. The refrigerant used is Freon. The compressor is driven by a 7½ hp. 115 volt DC motor while the train is in operation, but when the train is at terminals the compressor is operated by a 10 hp. 220 volt AC motor. During these periods, the 7½ hp. DC motor is operated as a generator to recharge the storage batteries. The air conditioning system embodies overhead units and center ducts. The ceiling ducts also incorporate an indirect lighting system which floods the compartments with a soft light yet sufficient for reading.

The berths are fitted with individual air conditioning outlets with independent control for each berth. Lighting fixtures consist of a reading light and a blue night-light for each berth. The entire sleeping compartment layout represents the last word in modern railroad comfort.

The power plant of the *Rebel* consists of a 600 hp. six cylinder four-cycle Alco type McIntosh & Seymour Diesel of 12½ in. bore and 13 in. stroke. The entire engine block is made up of welded rolled-steel sections in one piece, and the cylinder base is also made of the same welded construction. This construction has resulted in a weight reduction of more than 20 lbs. per hp. from the usual construction of cast cylinders and heavy cast base.

The cylinders are fitted with renewable liners which are easily replaceable. The cylinder heads are separate castings of semi-steel; this construction permits servicing any one cylinder without disturbing others. Each head contains two intake and two exhaust symmetrically arranged, as well as the fuel injection nozzle. The valve operating gear is completely enclosed and pressure lubricated.

The lubricating oil reservoir is located in the engine base below the floor level and all bearings and moving parts are lubricated under pressure by a power-driven oil pump located in the bottom of the base at the front end of the engine.

The engine drives no less than three Westinghouse generators simultaneously. The main generator, rated at 450 kw. at 740 rpm., provides power for the two electric motors driving

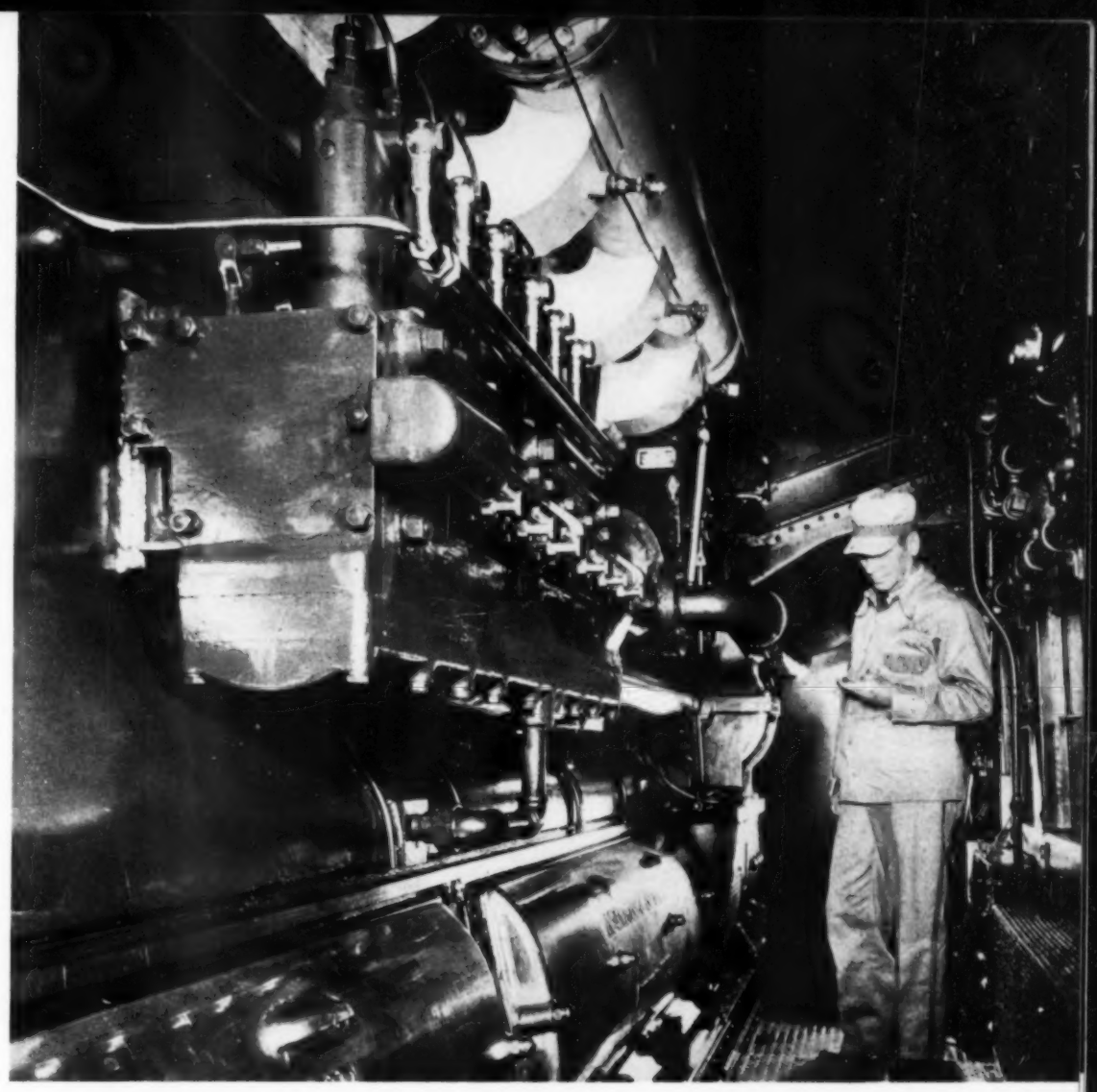
the car. An auxiliary generator, rated at 60 kw., delivers current at a potential of 130 volts DC for the operation of the compressor of the air conditioning system, radiator fans, generator excitation, lighting of the cars and for battery charging. The third and so-called control generator is used for operating the electric engine-control apparatus.

Motive power for the propulsion of the car is furnished by two electric motors of 275 hp. each, both driving a separate axle by means of gears with a ratio of 22 to 54. Current for the operation of the motors is furnished by the main generator of 450 kw. capacity.

During inclement weather, the cars of the "Rebel" are heated by the Vapor system with steam being supplied from a Clarkson boiler of the coil type. Two 300-gallon water tanks located within the baggage compartment provide feed-water for the boiler.

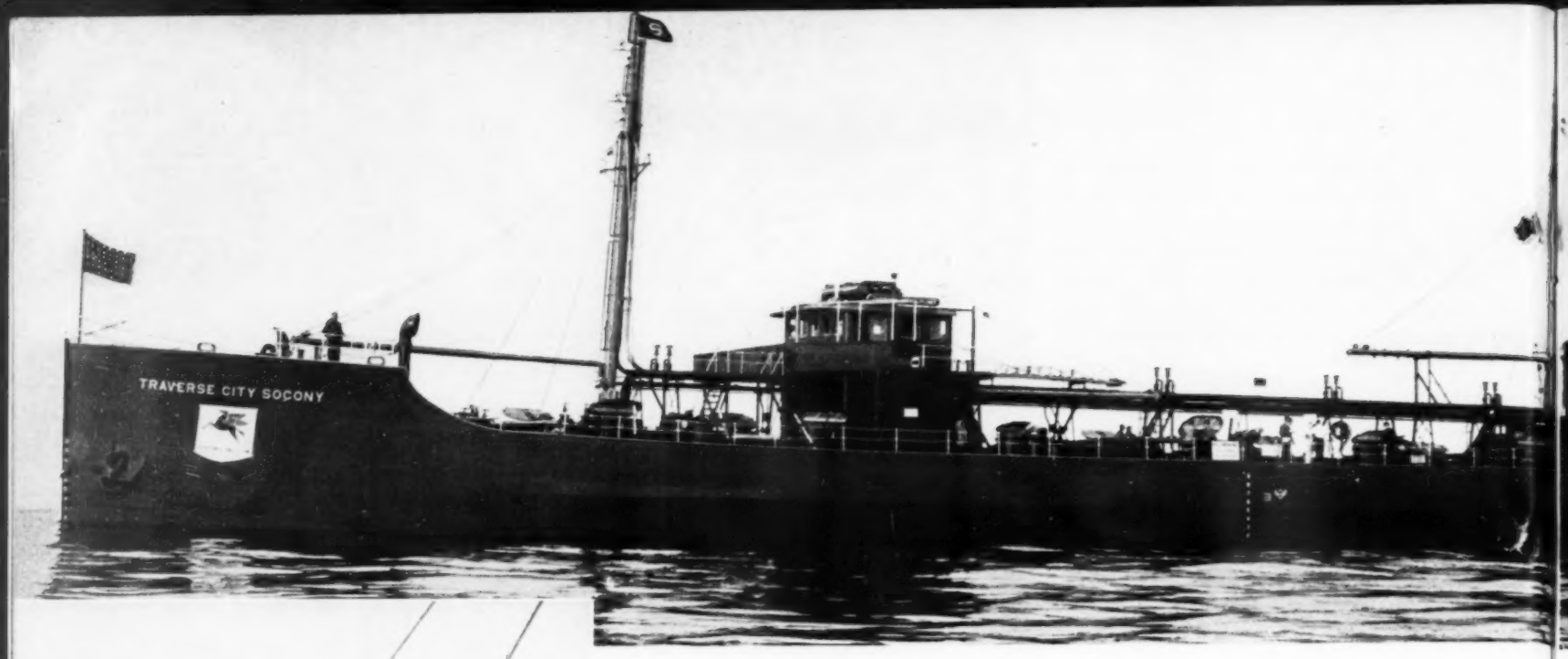
The cars are equipped with a dual heating system; fin heating coils are a part of the air conditioning system and fin-type radiators are placed at the base of the side walls of each car. The heat is controlled automatically by thermostats actuating magnet valves and Vapor constant-pressure regulators are also provided.

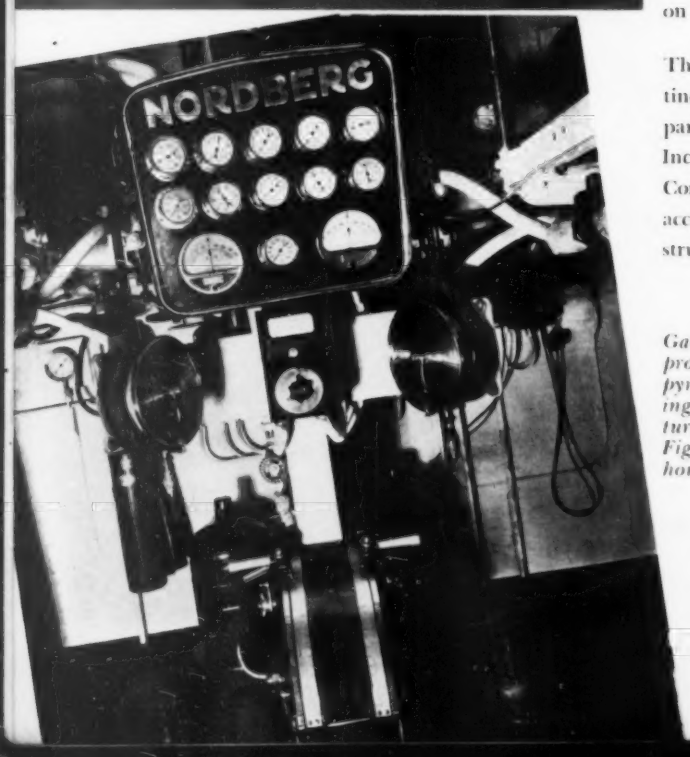
The "Rebel" streamline Diesel-engined trains of the Gulf, Mobile & Northern Railroad are but the pace-makers for the trains of the future. The Diesel engine is rapidly forging ahead and it is but a question of time when the steam locomotive will be outmoded and streamline Diesel trains will be standard for modern passenger services.



660 hp. McIntosh & Seymour Diesel installation in the "Rebel."

The original "Rebels" designed and built by American Car & Foundry for the Gulf, Mobile & Northern Railroad.





TRAVERSE CITY SOCONY!

By REX W. WADMAN

TRAVERSE CITY SOCONY, one of America's newest motorships, has recently been completed and is now in successful operation. A tanker especially designed for Great Lakes service by its owners – the Socony-Vacuum Oil Company, Inc., and built by the Manitowoc Shipbuilding Company. Propelling machinery consists of a pair of six cylinder, direct reversible, 750 hp. Nordberg four cycle Diesel engines. The *Traverse City Socony* is the first tanker of welded steel construction to be built on the Great Lakes for lake service.

The Motor Ship *Traverse City Socony* is a distinct credit to the Marine Transportation Department of the Socony-Vacuum Oil Company, Inc., to its builders, the Manitowoc Shipbuilding Company and to the engine manufacturers and accessory suppliers who contributed to its construction and equipment.

Gauge board and control station for the propelling engines. Alnor double duty pyrometer under board, supplying reading on both exhaust and water temperatures. Note direct reversing levers. See Fig. 1—page 23. Above—close-up of pilot house with Capt. Waddington "on deck."

The *Traverse City Socony* was designed and built for lake service and will operate primarily out of South Chicago, Indiana, servicing the company's bulk plants up and down the Great Lakes. She is, however, built and equipped every bit as well, every bit as completely as any of the company's ocean-going tankers.

Her principal dimensions, cargo capacities, speed, etc., appear hereunder.

Length overall	290′
Breadth	49′ 6″
Depth	20′ 6″
Gross tons	2,241.99
Net tons	1,352
Light displacement	1,400 tons
Draft (summer load line)	17′ 3⅛″
Deadweight at 17′ 3⅛″	4,390 tons
Cargo tanks	12
Total cargo capacity (gasoline)	1,209,372 gals.
Fuel capacity	26,620 gals.
Speed (cruising)	12.5 mph.
Fuel consumption at 12.5 mph.	100 gals. per hr.

Hull is constructed on longitudinal framing system and is electrically welded in the most

The Captain's Cabin which gives a good indication of comfortable and modern manner in which all officer's and crew's quarters are outfitted. Below—Port side of engine room showing F.M. 120 hp. unit with Almor pyrometer on post and duplex Nugent filters against bulkhead in rear.

of welding technique. Literally, hundreds of photographs were taken during the process of construction and we were very interested in going through these photographs and visualizing how the various sub-assemblies were built in the shop and then taken out and built into the ship.

As is so uniformly a general practice on the Great Lakes, the vessel was built on the banks of the river at Manitowoc and launched sideways – and very successfully so.

The vessel is driven by a pair of six-cylinder Nordberg 750 hp. four-cycle direct reversing mechanical injection Diesel engines, each driving a 5' 10" diameter propeller at 300 rpm.

The auxiliary machinery consists of a pair of Fairbanks-Morse eight-cylinder four-cycle Diesel engines developing 120 hp. at 900 rpm. which are direct connected to 70 kw. DC Fairbanks-Morse generators and through clutches to the main cargo pumps. There is, in addition, in the engine room, a Fairbanks-Morse generator set of 15 kw. capacity which is used for standby lighting service. For emergency lighting a set of Edison storage batteries are fitted to operate automatically.

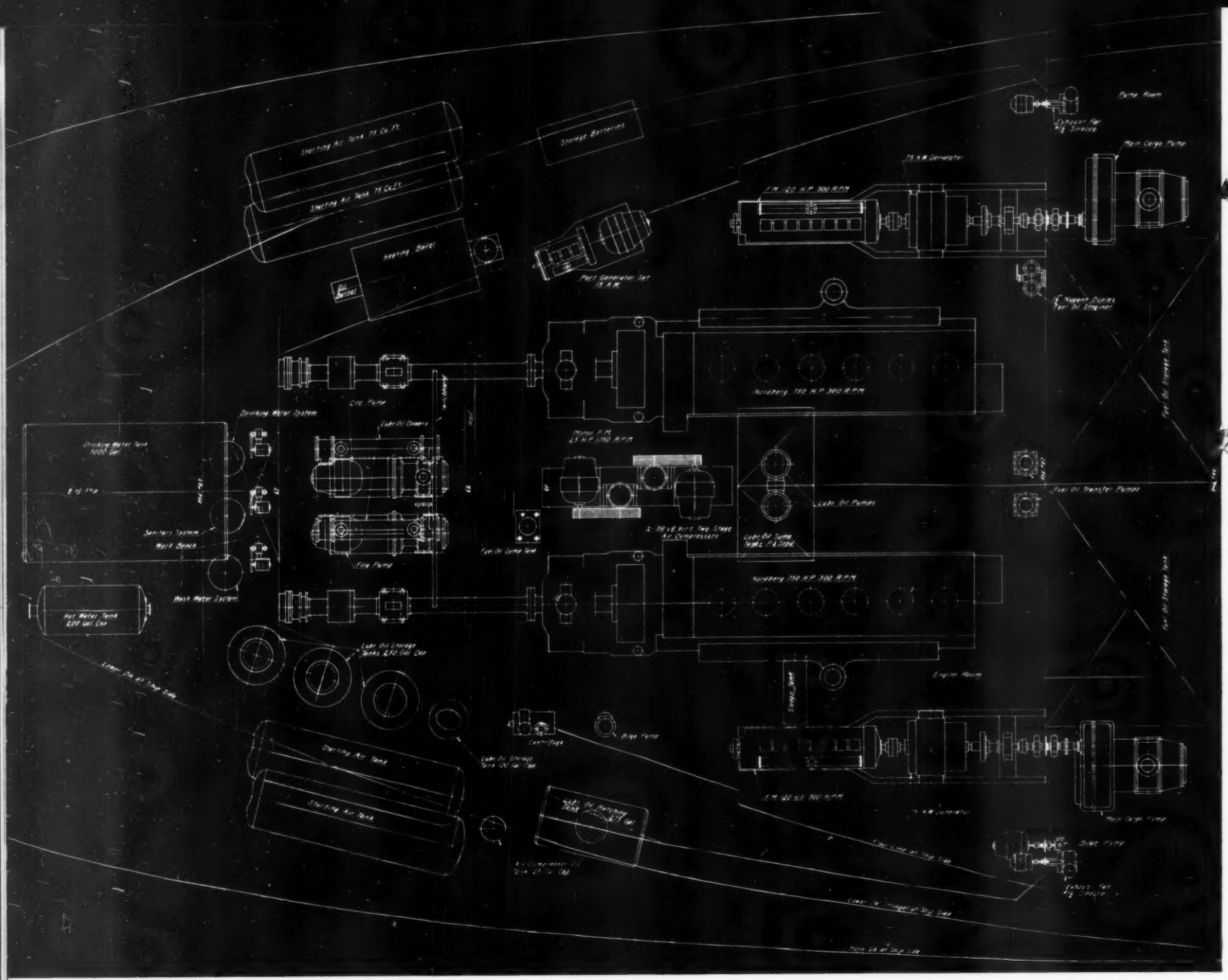
All service equipment such as Benson Electric Co. steering gear and deck winches, American Engineering Co. windlass and capstans, Northern Pump Co. fuel, bilge, fire and water pumps, Worthington air compressors, De Laval oil purifiers, etc., are electrically driven. In general the motors for deck machinery are of Diehl Mfg. Co. make and for the engine room equipment are of Fairbanks-Morse & Co. manufacture.

The pump equipment on this vessel, which is so essential to her successful operation, was supplied by the Northern Pump Co. and consists of the following:

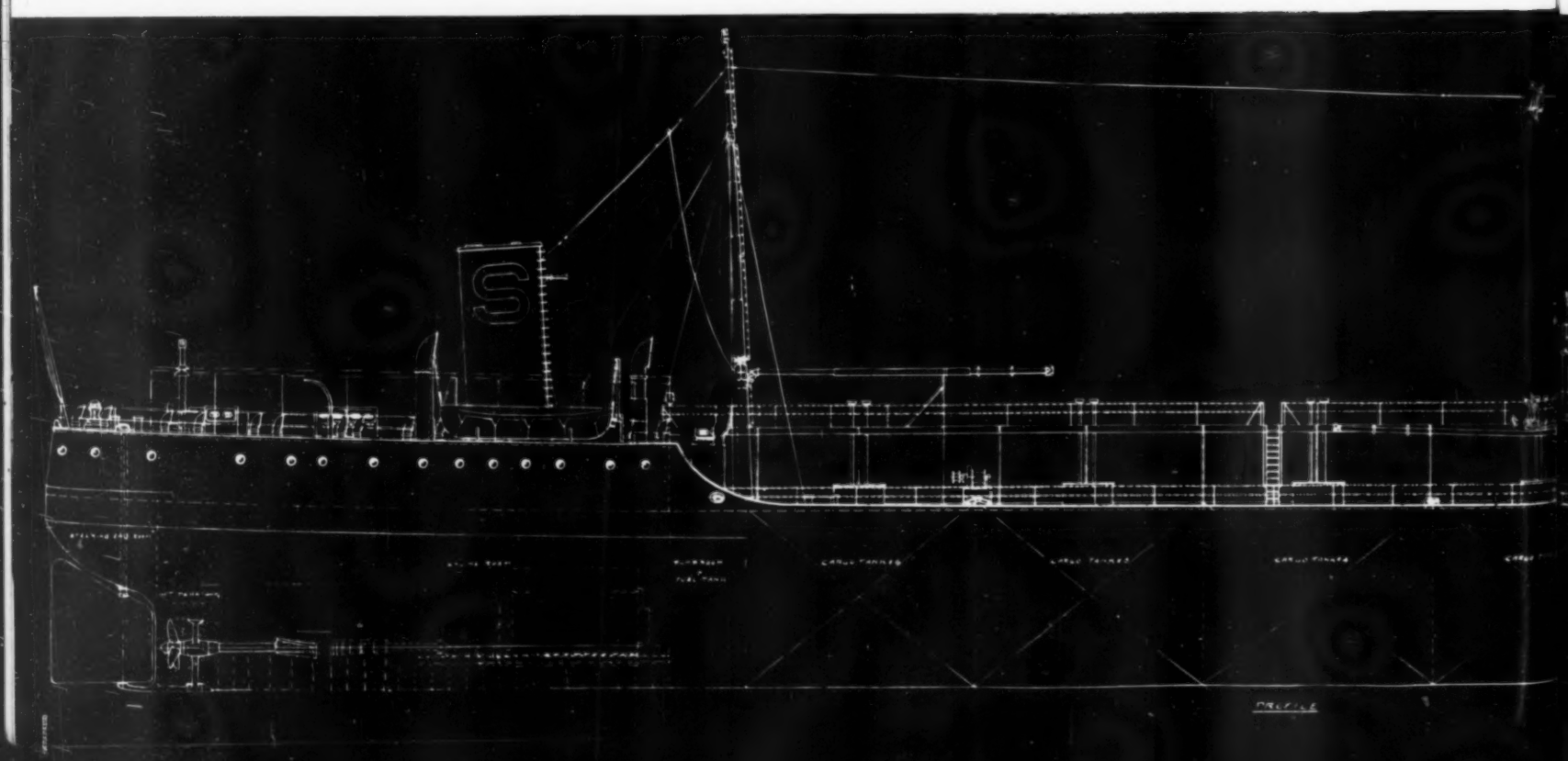
modern manner. Watertight and oiltight bulkheads and decks subdivide the hull into twenty-two watertight compartments including twelve cargo tanks, two ballast tanks, two fuel tanks, pump room, engine room, after peak, fore peak, dry cargo hold and cofferdam.

The bulkheads shell and deck were built as shop sub-assemblies and erected on the building ways. Approximately one thousand tons of steel were used in the construction necessitating nearly one hundred thoustand feet of electric welding.

The Manitowoc Shipbuilding Company did a splendid job of welding throughout this vessel. The deck especially is an outstanding example



Engine room layout of the "Traverse City Socony" illustrating the compactness of the machinery arrangement and completeness of the equipment installed. The vessel is designed primarily for carrying gasoline, so every precaution has been taken against fire hazards.



Two main cargo pumps – Horizontal
Capacity 1230 gpm. – Gasoline – each
Driven by Fairbanks-Morse & Co. Diesel engines
Engine speed 900 rpm. – Pump speed 198 rpm.

Note: Pumps have built-in reduction gear, having hardened and ground pinion and pilot gears; also positive lubrication supplied by built-in lubricating oil pump.

One ballast pump – Vertical
Capacity 460 gpm. – At 25 lbs. pressure
Driven by Diehl vertical motor
25 hp. at 1750 rpm. – Pump speed, 391 rpm.

Two circulating water & fire pumps–Horizontal
Capacity 400/200 gpm. at 25 to 110 lbs. pressure
Driven by Fairbanks-Morse motor
20 hp. at 1750/875 rpm.
Pump speed 330/170 rpm.

One engine room bilge pump – Vertical, self-priming
Capacity 100 gpm. at 30 lbs. pressure
Driven by Fairbanks-Morse motor
5 hp. at 1750 rpm. – Pump speed 556 rpm.

One pump room bilge pump – Horizontal
Capacity 50 gpm. at 20 lbs. pressure
Driven by Fairbanks-Morse motor
3 hp. at 850 rpm. – Pump speed 850 rpm.

Two fuel oil transfer pumps – Vertical
Capacity 25 gpm. at 30 lbs. pressure
Driven by Fairbanks-Morse motor
1½ hp. at 850 rpm. – Pump speed 850 rpm.

Navigating equipment consists of Sperry gyro compass and rudder angle indicator, Bludworth radio direction finder, Kelvin magnetic compasses, engine speed and direction indicators, electric sounding machine and other equipment of the most modern type.

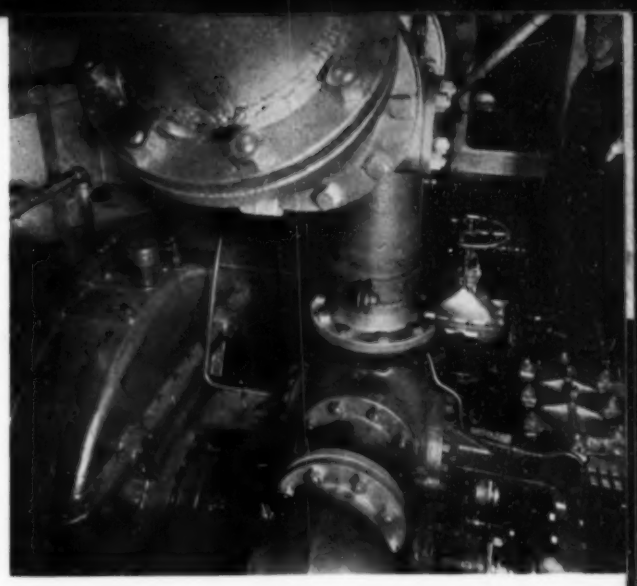
Cargo spaces, pump rooms and engine room are protected against fire by Lux carbon dioxide system. A fire line capable of supplying water at 125 lbs. pressure at hose outlets and chemical hand fire extinguishers are used to protect other parts of the vessel.

Insulated and fireproofed living quarters are provided in the after end of the ship for the crew fitted with metal furniture throughout, designed and built by L. F. Dietz & Associates. The crew consists of six officers and from twelve to fifteen men.

A Crane oil fired steam boiler is fitted in the engine room to supply steam to the heating system. Crane fittings and valves are used throughout the vessel. Hot and cold running water is supplied to each stateroom and to the showers in the bathrooms.

The galley is equipped with a Webb oil burning range and with a refrigerator cabinet, dressers and sink of stainless steel. Kelvinator automatic electric refrigeration is provided to care for galley supplies and to cool drinking water.

The outstanding pieces of auxiliary equipment in the engine room consist of a double-duty Alnor pyrometer mounted immediately under the gauge board. This pyrometer supplies readings for both the exhaust and water temperatures for both the Nordberg propelling engines. In addition, an Alnor round-type pyrometer is mounted on the upright beside each of the



Looking down on one of main Northern Cargo Pumps which is driven through a clutch by a 120 hp. Fairbanks-Morse Diesel.

eight-cylinder Fairbanks-Morse pumping engines.

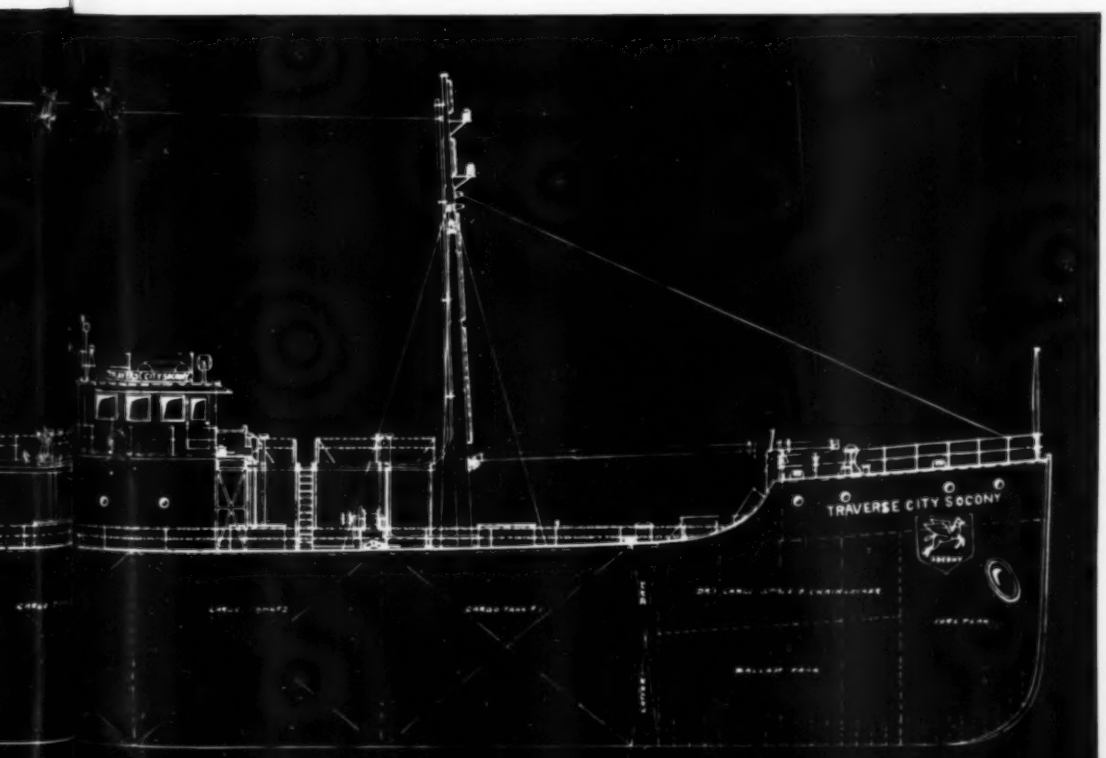
Each main engine is equipped with an electric tachometer. Indicators, enclosed in marine cases and reading Ahead and Astern, are in the engine room and in the pilot house. The magneto, driven from the engine cam shaft, is so designed that the armature is in a vertical position, the winding and commutator being above the ball bearings, thus insuring clean brushes, resulting in accuracy and permanency of calibration.

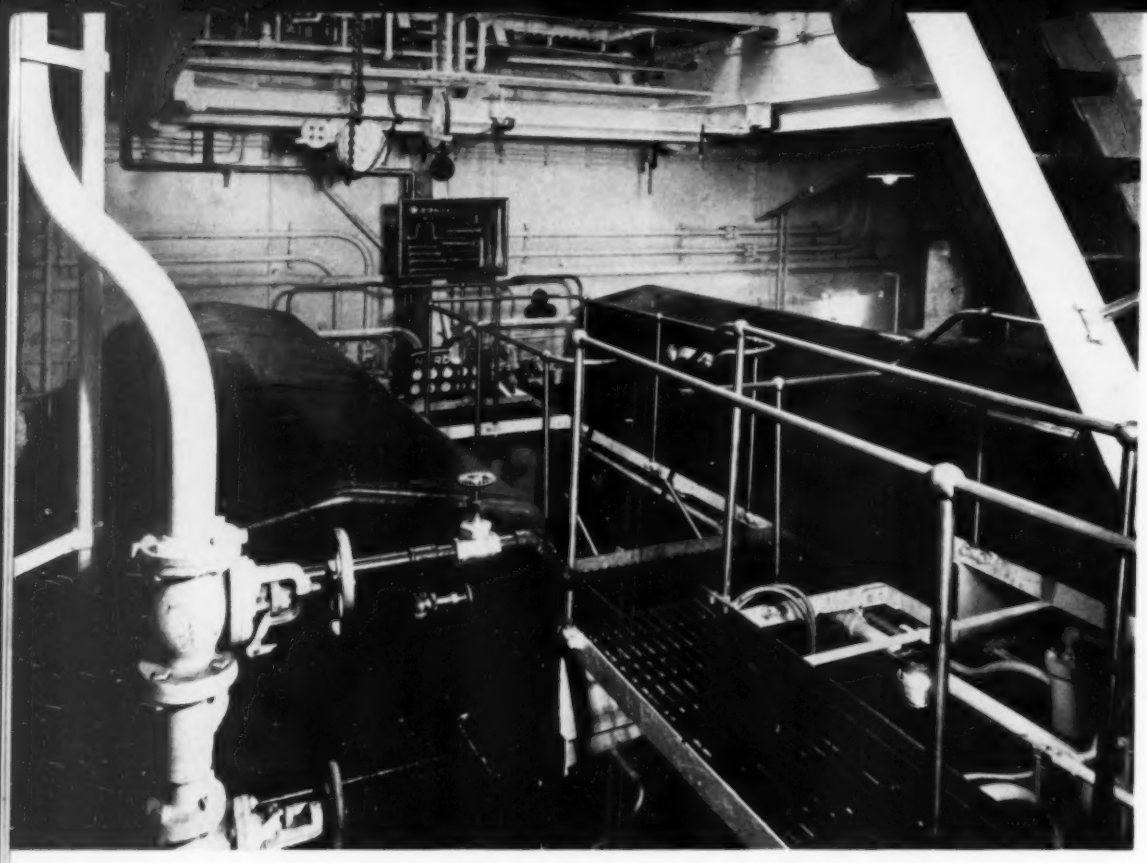
An additional feature is the eight-figure unidirectional revolution counter, additive ahead and astern, which is driven from the magneto gearbox. The complete equipment is manufactured by The Electric Tachometer Corporation.

Fuel oil is passed through duplex Nugent filters which may be seen attached to the engine room bulkhead on the port side between the eight-cylinder Fairbanks-Morse and the port propelling engine.

Purification of lubricating oil is handled by a De Laval centrifugal unit installed on the starboard side of the engine room aft of the bilge pump. Further details of the main engines and their equipment will be found on the two following pages.

One of the interesting but necessary pieces of equipment on a vessel of this type is the two-tone Kahlenberg horn mounted on the stack. Inside this same stack is located three model SC 2 Maxim spark arrestor silencers handling the exhaust of the three Fairbanks-Morse engines and a pair of Vortex spark arresting silencers handling the exhaust of the two Nordbergs.





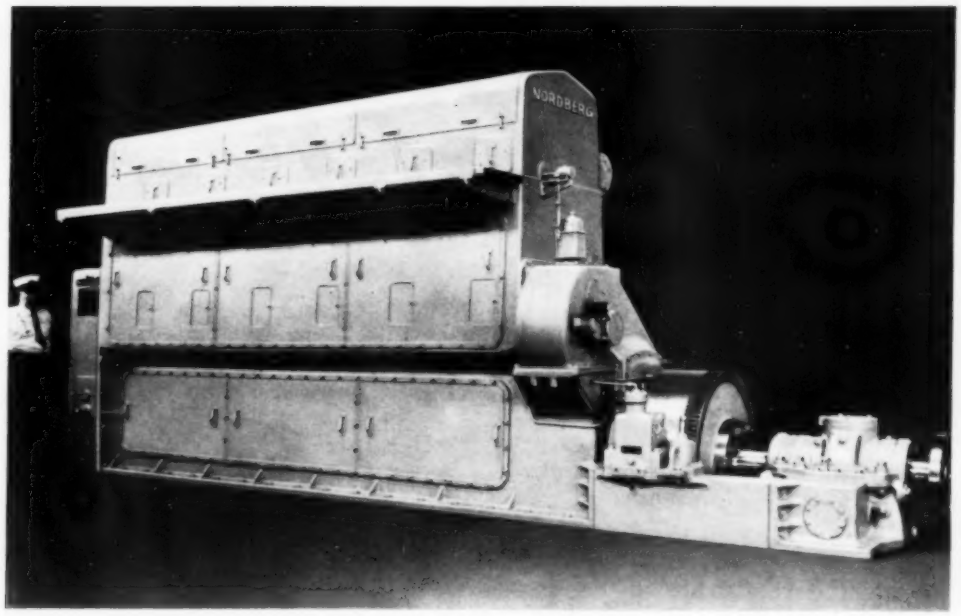
Looking down on the two main Nordberg six cylinder 750 hp. four cycle Diesel engines installed in the "Traverse City Socony." Engines are fully enclosed yet readily accessible.

THE tanker "Traverse City Socony" is propelled by two (2) 6 cylinder, 4 cycle, direct-reversible Nordberg marine Diesel engines, each developing 750 hp. at 300 rpm., or a total of 1,500 hp. for the ship. These engines are of 16″ bore and 22″ stroke with mechanical injection of the fuel, and are of trunk piston construction, the standard design for Nordberg engines of the 4 cycle type. Each engine is equipped with a Kingsbury self-lubricating, adjustable thrust bearing mounted on rigid beams bolted to the engine bedplate as shown in photograph 3711.

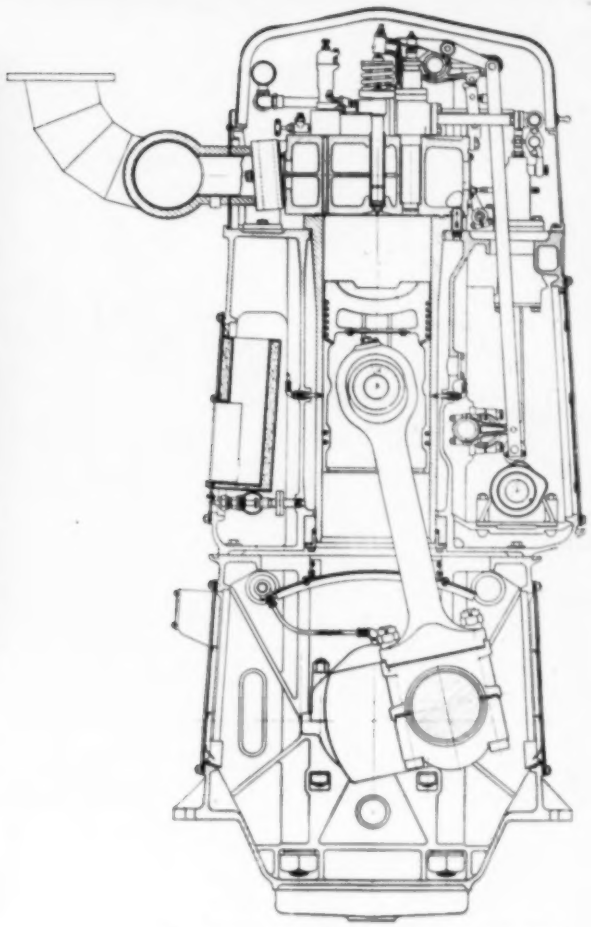
The general construction of these engines includes a number of the very important features commonly found with Nordberg designs. From the section view, it will be noted that the bedplate and cylinder block are tied together with long through bolts which extend from below the main bearings to the top of the cylinder block. These bolts relieve the castings of tension stresses set up in the operation of the engine and tie the engine into a very rigid unit. The engines are completely enclosed, and the exterior surfaces are smooth and flat which aids materially in keeping the units clean. The cam shaft, valve gear, push rods, and fuel pump are located back of the large removable covers on the front side of the cylinder block, affording great accessibility to these vital parts. By removing the large covers on either side of the bedplate, ready access is obtained to the main and crank-pin bearings. The entire top of the engine is enclosed with sectional hinged aluminum covers, but these, however, can be swung back when desired to afford easy access to the cylinder heads and overhead valve gear parts. The built-in Burgess air filter units for filtering the air intake are placed in the covers on the cylinder block on the exhaust side. These filters are furnished with silencing walls, therefore, noise is reduced to a minimum.

The engines are equipped with mechanical force-feed lubricators for lubricating the power cylinders. All other working parts such as the main bearings, connecting rod bearings, cam shaft bearings, valve actuating mechanism, etc., are served by a circulating force-feed system. No hand oiling of any kind is necessary anywhere on the engine. This lubricating system is so arranged that the lubricating oil returning from the bearings gathers in the sumps located fore and aft of the engine bedplates, and from there is drained to a common sump tank located in the ship's bottom. From this sump tank, the oil is pumped by means of a separately motor-driven pump through strainers and an oil cooler, and then led to each main bearing through the drilled passages in the crank-shaft and crank pins to the crank-pin bearings, thence through the hollow connecting rods to the piston pin bearings. By means of tubing and drilled holes, oil is also led to the other smaller parts requiring lubrication. Because of the fact that the engines are completely enclosed, no oil splash or oil dripping is found on the exterior of the engine.

The reversing and control of each engine is very unique. each engine is controlled by a single hand lever mounted on a common central control stand located forward between the engines. The single control lever may be observed by referring to figure 1. When the lever is at its center position, the engine is in the stop position, but when moved either ahead or astern it starts the engine in that direction and controls the engine speed in accordance with the amount of movement given to the lever in either direction. When the lever is in either of the extreme positions of travel, the engine will operate at its maximum speed of 300 rpm. in that direction. The reversing gear is actuated by an air-operated reversing cylinder in tandem with an oil cylinder. The



Photograph No. 3711 referred to on opposite page. A shop view of one of the Nordberg main propelling engines, with the Chief Engineer of "Traverse City Socony" standing beside it.



Cross section of the Nordberg main propelling engines in the "Traverse City Socony."

oil cylinder acts as a governor for the air cylinder so that the reversing of the cam shaft may be made at an even speed. This oil cylinder is also so arranged that it can be used as a reversing cylinder in the event that no air is available. The movement from the air-operated reverse piston rod is transmitted through a rack which engages gears and turns the maneuvering shaft one revolution. When the maneuvering shaft is thus turned, the cam shaft is shifted laterally for the running position in the new direction. This control is positive and quiet and reverses the engine from full speed ahead to full speed astern, or vice versa, in from 4 to 6 seconds, depending merely upon the quickness of the operator. Automatic interlocks are built into the enclosed control boxes and no wrong movement can be made by the operator of the single control lever. While the speed of the engines within the normal range of operation is controlled by the position of the control levers each engine is equipped with a Woodward marine type overspeed governor which holds the engine speed within maximum limits.

The cast iron bedplate containing main bearings and completely housing the cranks extends upward to meet the cylinder block; no intermediate frame being necessary. The main bearings have removable two-piece steel shells lined with Satco centrifugally-cast babbitt. The cylinder block and removable liners are made of special Nordberg alloys of cast iron, and heat treated. The cylinder heads are also made of a special cast iron alloy and contain the inlet and exhaust valves as well as the starting valves, all of which are mounted in cages. The exhaust valves are water cooled.

With the engines arranged for mechanical injection of the fuel, each cylinder has its own cam-actuated fuel pump bolted to the cylinder block above the cam shaft and near the cylinder it serves. Each pump can be cut in or out of operation and is provided with a hand priming device.

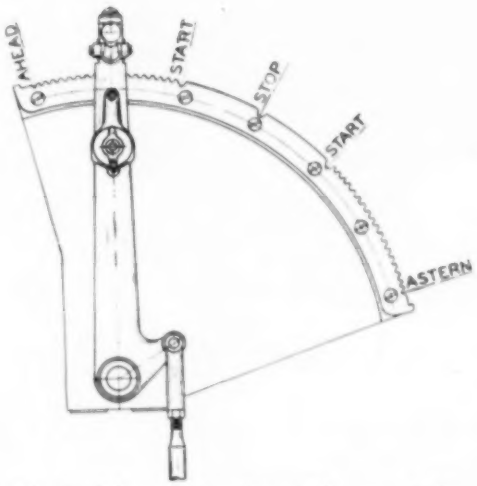


Fig. 1. Schematic drawing of the one of the two control quadrants for direct reversing. One lever handles the entire cycle from full ahead to full speed astern. *See photo on page 18.*

M. S. "Traverse City" leaving Manitowoc Harbor for Traverse City, Mich., on her trial trip.

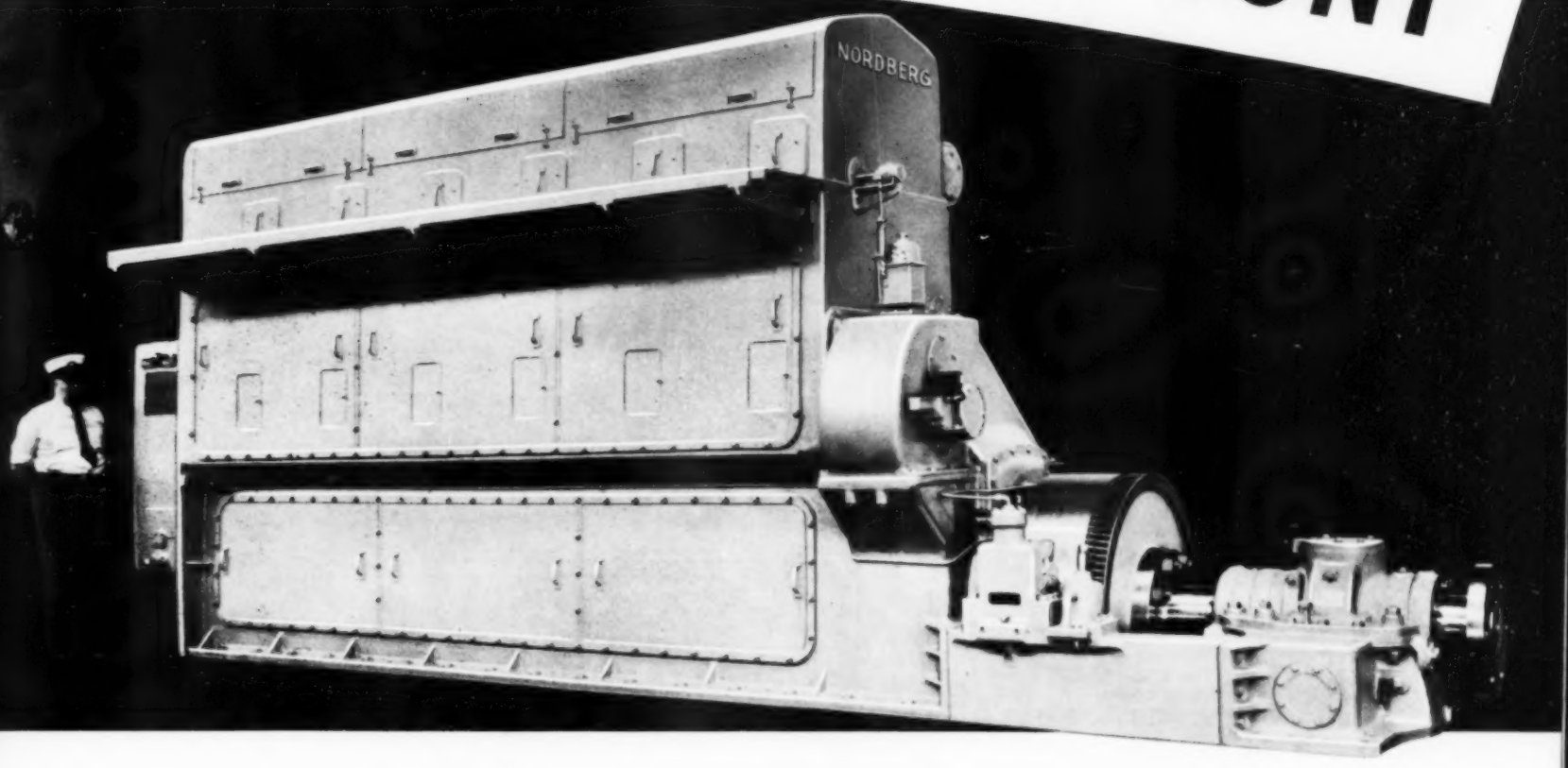
For the New Tanker...

Nordberg Marine Diesel Engines are built in two and four cycle types. Direct reversing, non-supercharged, four cycle engines range in size from 750 to 1000 H. P.; and supercharged from 1000 to 1500 H. P. Direct reversing, two cycle engines are built in sizes from 1250 H. P. upward. Both two and four cycle types in the medium and larger sizes are also available for Diesel electric and gear drives and for driving various ship's auxiliaries.

As licensee for Burmeister & Wain, Europe's leading builder of marine Diesels, users of such equipment in this country can now benefit by the designs and the combined experience and facilities of these two outstanding Diesel engine builders. With Nordberg two and four cycle engines furnished in a wide range of sizes, it is possible to select an engine from this extensive line which best meets the requirements of marine service.

NORDBERG MARINE

TRAVERSE CITY SOCONY



THIS new twin screw Great Lakes tanker, built by the Manitowoc Ship Building Company for the Socony-Vacuum Oil Company, Incorporated, is propelled by two six cylinder, single acting, four cycle, direct reversible Nordberg Diesel engines of 16 inch bore and 22 inch stroke, each developing 750 horsepower at 300 R. P. M. Mechanical injection of the fuel is employed. One of the novel features of this installation which was developed by Nordberg is a single lever control for each engine, both control levers mounted on a central control stand located between the engines and forward in the engine room. By moving either lever from the center STOP position, either unit is started AHEAD or ASTERN as desired and will operate at a speed corresponding to the amount of movement given to the lever in either the AHEAD or ASTERN positions. The engines can be reversed in from four to six seconds when operating at full speed.

NORDBERG MFG. CO., MILWAUKEE, WIS.

DIESEL ENGINES

CHIPPEWA FALLS, WIS.

By E. B. WAYTS*

THE Wisconsin Power Co-Operative is an association of farmers and its object is to distribute electricity to some 10,000 farms located within a radius of 70 miles from the central power plant. It is the first large generating plant in the United States to furnish electric power exclusively for rural use.

The project was sponsored by the Rural Electrification Administration and the Wisconsin Power Co-Operative was formed in 1937. Numerous locations in Western Wisconsin were suggested for the erection of a central generating plant, and, after careful study and due consideration as to railroad facilities, main highways, water supply and intersection with high line feeders to distribute the electric energy to various projects, a site located four and one-half miles north of Chippewa Falls, was chosen.

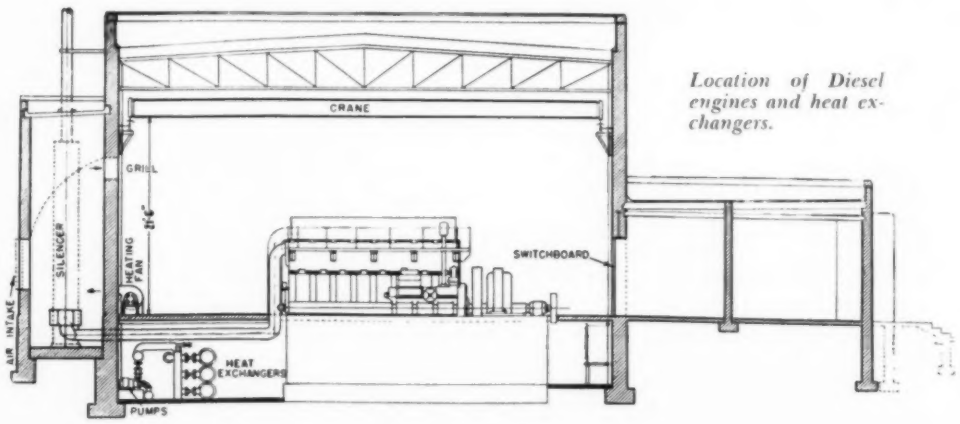
The site, located at the junction of the C. St. P. M. & O. R. R. and U. S. Highway No. 53, is an ideal one; a three car siding has been provided with fuel unloading stations spaced 50 ft. apart, so that three tank cars can be spotted and unloaded at once. A 2½ in. pipe line with a motor driven fuel unloading pump and meter runs to two underground fuel storage tanks of 30,000 gallon capacity each.

In the basement of the plant, a motor driven Viking fuel pump transfers the oil from the storage tanks to the engine's service tanks. Each engine is provided with its own day service tank holding approximately 150 gallons of fuel. The oil from the storage tanks may also be by-passed into a clean-oil tank of 5,000 gallon capacity located underground, or it may be centrifuged by means of a Goulds Hydrol unit on its way to the clean oil tank.

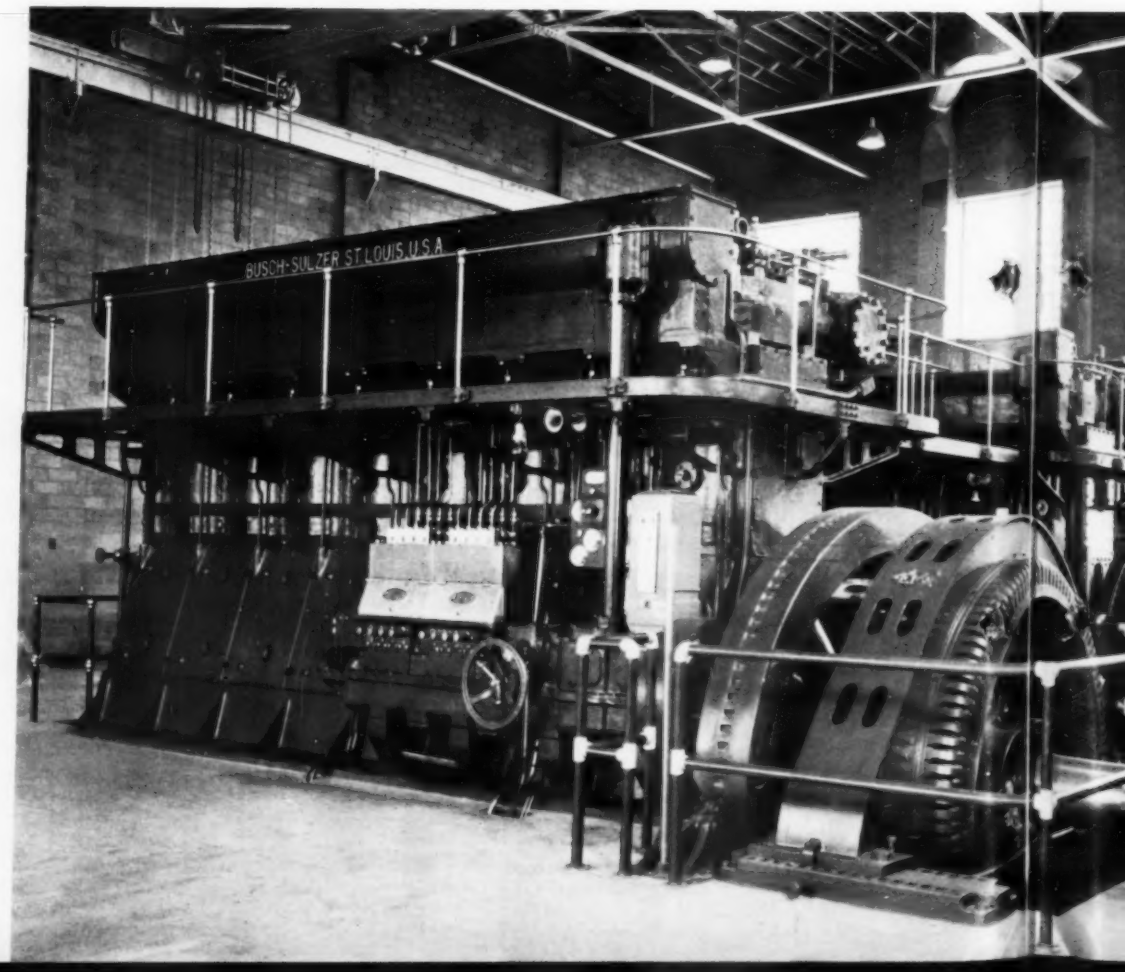
The Wisconsin Power Co-Operative's plant at Chippewa Falls generates and supplies electricity to 10 member co-operatives at wholesale cost, who in turn distribute the current to the various farms located within their districts. It is expected that the generating plant will ultimately service no less than 12,000 farms.

The generating plant is of modern construction, concrete and structural steel with brick facing. The windows are made of, and the main double-door entrance is surrounded with, glass-blocks. Thus, the appearance of the building, is striking and yet of classic simplicity. The building is relatively large, the overall length is 85 ft. and the width is 65 ft. The total cost of the plant is $775,000 and is repayable to the REA with interest at 2.88 per cent per annum over a period of twenty years. The present generating capacity of the plant is 2,100 kw., but provisions have been made for an additional 2,400 kw., which will give an ultimate total capacity of 4,500 kw. as and when required.

The power plant consists of three 1,000 Busch-Sulzer mechanical injection, 8-cylinder, 4-cycle Diesels of 16¼ in. bore and 24½ stroke, turning at 257 rpm. They are directly coupled to three Electric Machinery Mfg. Co. 875 kva. (700 kw. at 0.8 power factor) 2,500 volt 3-phase 60-cycle generators. The field exciters



Location of Diesel engines and heat exchangers.

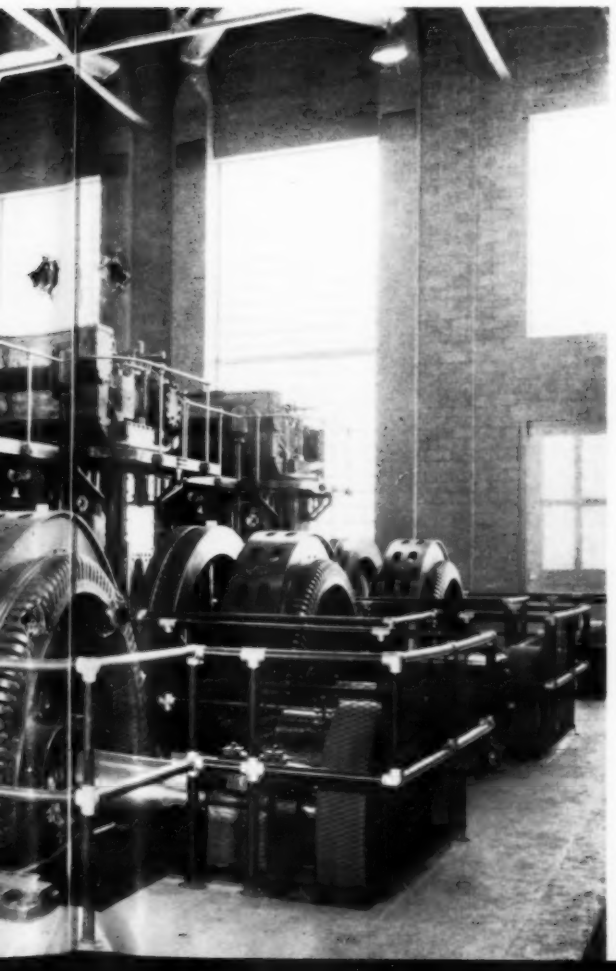


*E. B. Wayts, Manager, Wisconsin Power Co-Operative, Chippewa Falls, Wis.

The impressive building of the Chippewa Falls Diesel-electric plant operated by the Wisconsin Power Co-Operative.

are belt driven at a speed of 1,450 rpm. and are of 15 kw. output at 125 volts.

Modernity is the key-word of the entire plant, its layout and equipment. The Banister Engineering Co. were the Consulting Engineers and Mr. L. R. Graham the Resident Engineer. The Busch-Sulzer Diesels are equipped with Woodward type IC governors and Alnor pyrometers. Dust-free air is supplied to the engines by huge American type SCF filters of 3,200 cfm. capacity. The exhaust is silenced with 12 in. type DO4F Maxim silencers. The lubricating oil is cooled by Ross oil coolers. The engines operate with a closed cooling system using soft water only. The heat of the cooling water is dissipated by means of Ross heat exchangers and a Marley cooling tower.



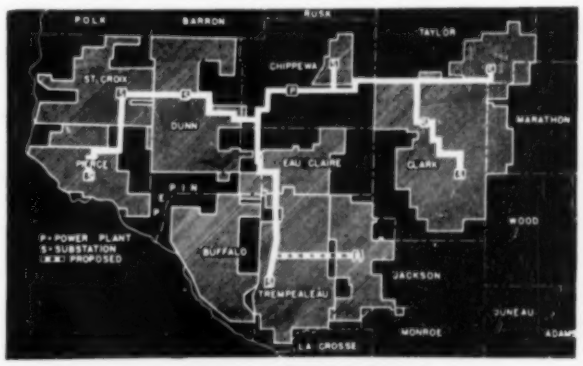
Generating plant, three Busch-Sulzer Diesel engines.

The plant is heated from the Diesel engine exhaust. Each Maxim silencer is housed in so that the heated air can be circulated around by fans. This system heats the engine room proper in an adequate manner. The other parts of the plant are heated by means of Ross heat-exchangers of 660 sq. ft. capacity. These derive their hot water from the water-jacketed exhaust manifolds of the engine, and the water so heated is carried by pipes to unit heaters placed where heat is required.

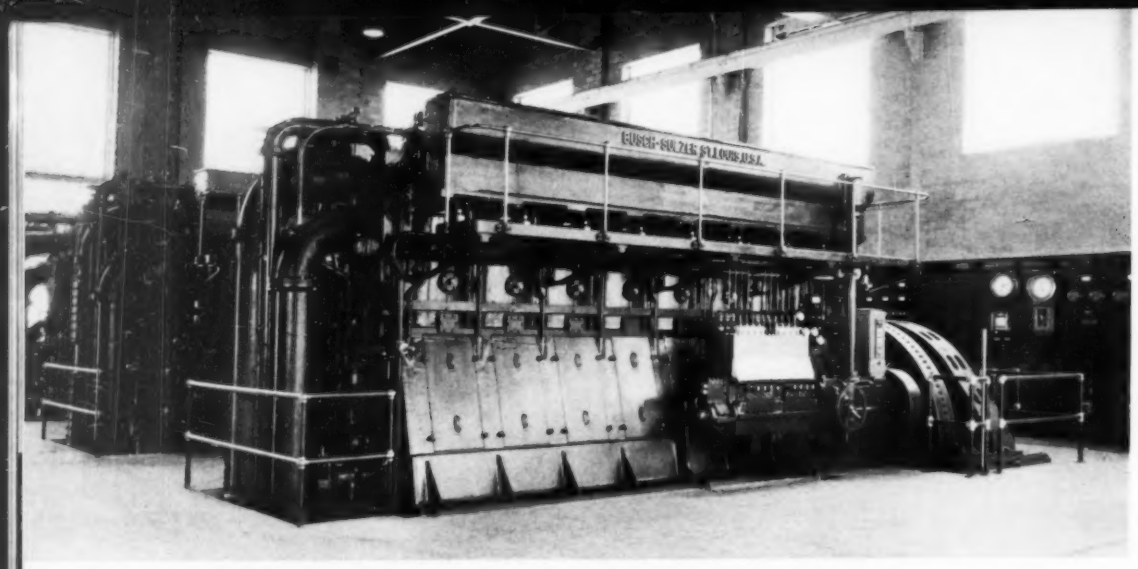
The water needed for the operation of the engines is rain water collected from the roof, as well as water drawn from wells. The roof is of flat construction and rain leaders carry all soft water to an underground reservoir of 11,000 gallon capacity for the jacket water of the Diesel engines.

During dry periods or when the rain water supply is not sufficient, water drawn from the wells is used to augment the circulating cooling water. Although the well water is relatively soft, it is not indiscriminately mixed with the rain water but is softened and filtered first. Since the entire cooling system is of the closed type, Ross heat exchangers and the Marley cooling tower in which raw well water circulates, are used to absorb the heat from the engine's cooling water. The heat exchangers receive water at the rate of 300 gallons per minute, which is drawn from the base of the cooling tower and returned to the top. The water within the cooling tower is maintained at a certain level and the water lost by evaporation is replenished from the well water supply as needed.

The station switchboard is of Westinghouse make and consists of three gneerator panels, two auxiliary and one feeder panel. Two additional auxiliary and one extra feeder panel are reserved for future use when the demand for electricity requires the extension of the service. Three Westinghouse station type trans-



Section of map showing area in Western Wisconsin served by Chippewa Falls Diesel-electric plant.



View of the three 1,000 hp. Busch-Sulzer Diesels with switchboard in the background.

formers of 37½ kw. capacity provide voltages of 2,400/240-120 for station power requirements.

The power generated is carried by means of underground cables to a nearby steel tower switching and transformer sub-station. Here three General Electric grounded Y transformers of 667 kva. capacity step-up the generated voltage from 2,500 to 33,000 volts.

The current is distributed at this voltage at a wholesale price to the 10 member co-operatives, who in turn run their supply lines at a potential stepped-down to 6,900 volts. Final delivery of electricity at "retail" price to the individual farmers is at a potential of 240 volts for power use and 120 volts for the lighting circuits.

Those familiar with the distribution system of private public utilities will recognize that the Wisconsin Power Co-Operative makes use of an identical arrangement, i.e., high voltage feeders to distribution points to reduce line losses, and then a step-down to voltages customary for ordinary power and light circuits.

As may be seen from the distribution map, the line system is roughly T shaped and is divided into three legs. The feeder and sub-feeder lines are quite extensive, the Wisconsin Power Co-Operative has provided 243 miles of 33 kw. transmission lines while the local distributing co-operatives have built some 2,250 miles of 6,900 volt lines together with transformer stations to reduce the voltage to be metered at 240 respectively 120 volts.

This, then, indicates the magnitude of the whole project, and since the electric system supplies power and light current to farms of no less than 11 counties, its social significance is manifest.

The modern farmer needs power and light, but electricity must be sufficiently low in price to be economically possible, and that calls for electricity generated by Diesel engines. The power requirements at farms are for –

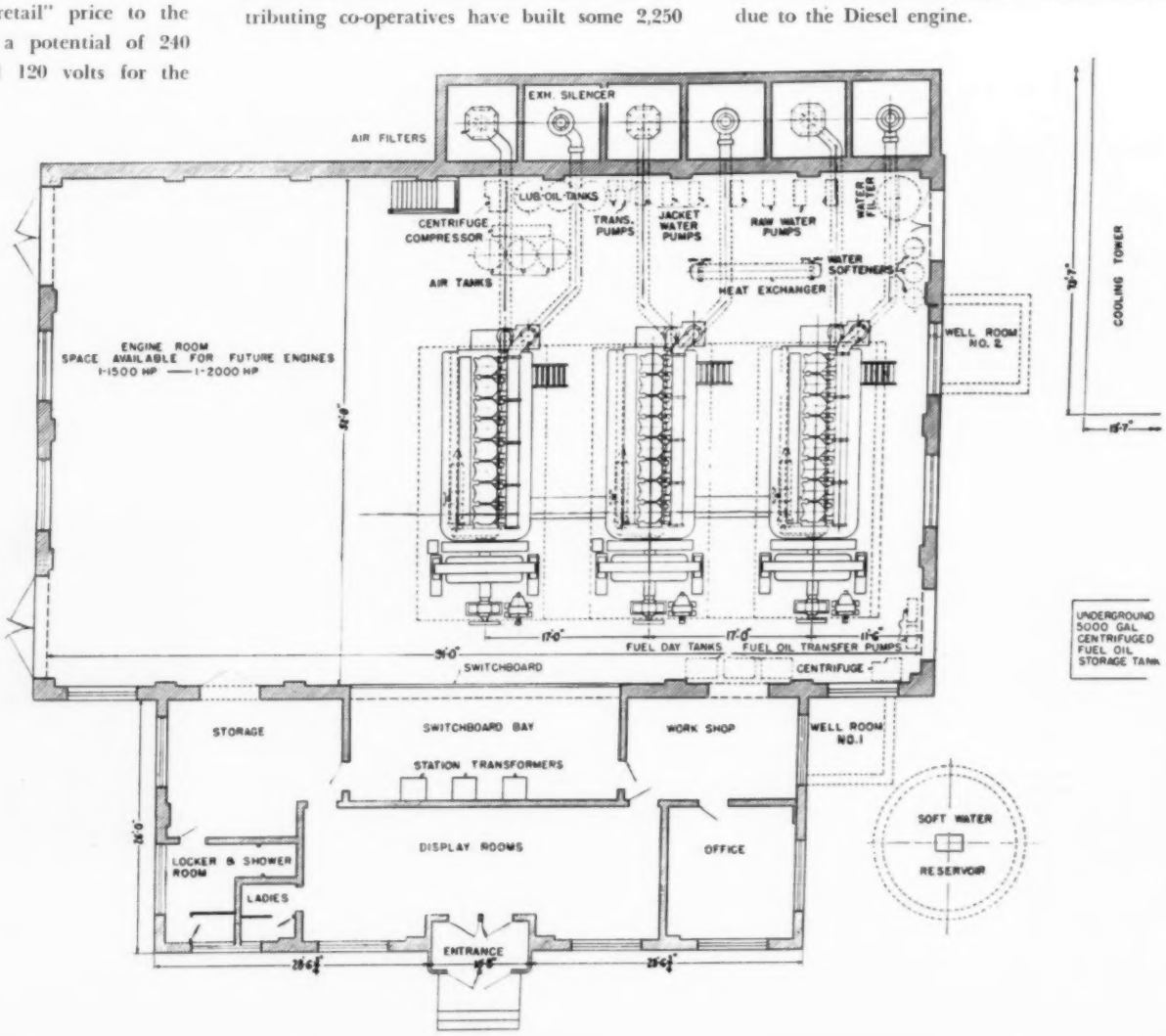
- Water pumps
- Feed grinders
- Milking machines
- Refrigerators and coolers
- Brooders, etc.

and then at the farmhouse for –

- Refrigerators
- Flat irons
- Toasters
- Fans
- Radios

and a multitude of other electric utensils quite apart from lamps.

Just as the automobile has replaced the buggy, electrictiy has done away with back-breaking muscle power and dangerous kerosene lamps, due to the Diesel engine.



Plan of the station showing the arrangement of the present three 1,000 hp. Busch-Sulzer engines and the space provided for two future units, one 1,500 and one 2,000 hp. Auxiliaries are located in the basement.

B. M. W. LANOVA 114 DIESEL

By PAUL H. WILKINSON

ALTHOUGH for the past few years the Bavarian Motor Works (otherwise known as B.M.W.) has been developing a radial Diesel for aircraft, it is only recently that exclusive and authentic information has been obtained. This information concerns the B.M.W.-Lanova 114-V2 air-cooled engine, and its corresponding liquid-cooled version, the B.M.W.-Lanova 114-V4. It shows that in Germany the radial Diesel as well as other types has reached a high state of development. This is particularly significant inasmuch as B.M.W. engines are known to be used extensively for military fighting planes.

In 1931, B.M.W. commenced their Diesel development program, using as their basic design the "Hornet" gasoline engine which they manufactured under Pratt & Whitney license. To the well-tried parts of the nine-cylinder American radial, they added the Lanova combustion system, replacing the carburetor and magnetos with which originally it was equipped. This resulted from the very first in a Diesel which functioned with efficiency and reliability, and furthermore, it saved considerable time and expense. Choosing an engine of standard size has the further advantage that the Diesel, when produced, can be quickly installed in fighting planes, replacing the gasoline engine.

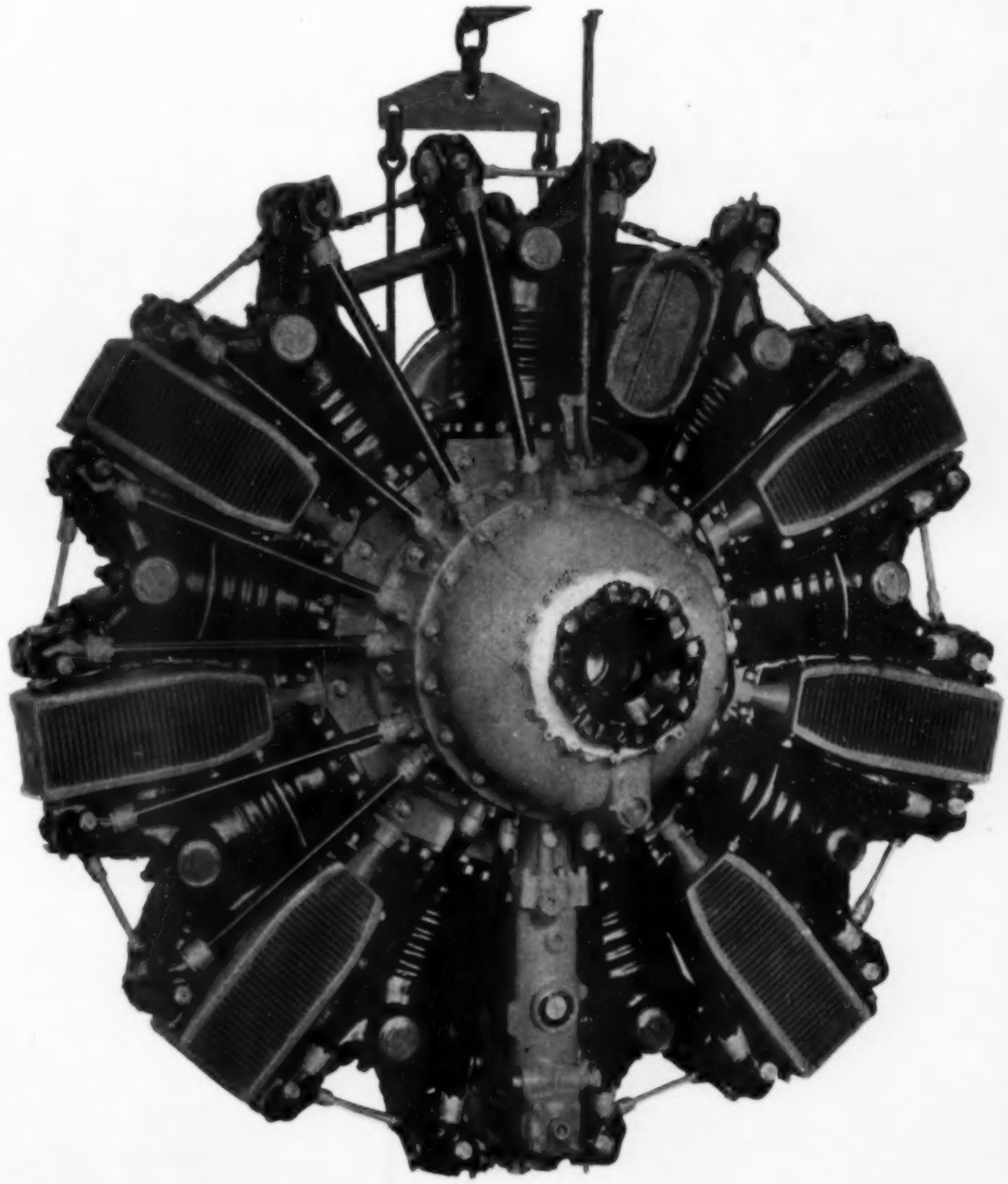
In the case of their liquid-cooled engine, the preliminary tests so essential for this kind of work were made with a single-cylinder engine having a bore and stroke of 5.98 in. and 6.38 in. respectively, and a displacement of 177 cu. in. In its original form, it had an output of 53 indicated hp. at 2,000 rpm. and a fuel consumption of 0.385 lb. per hp. per hour. Later, with the addition of pre-injection (or pilot injection of a small charge of fuel to start combustion and eliminate ignition delay) this consumption was reduced to 0.335 lb. per indicated hp. at full load—and this was accomplished without resort to supercharging.

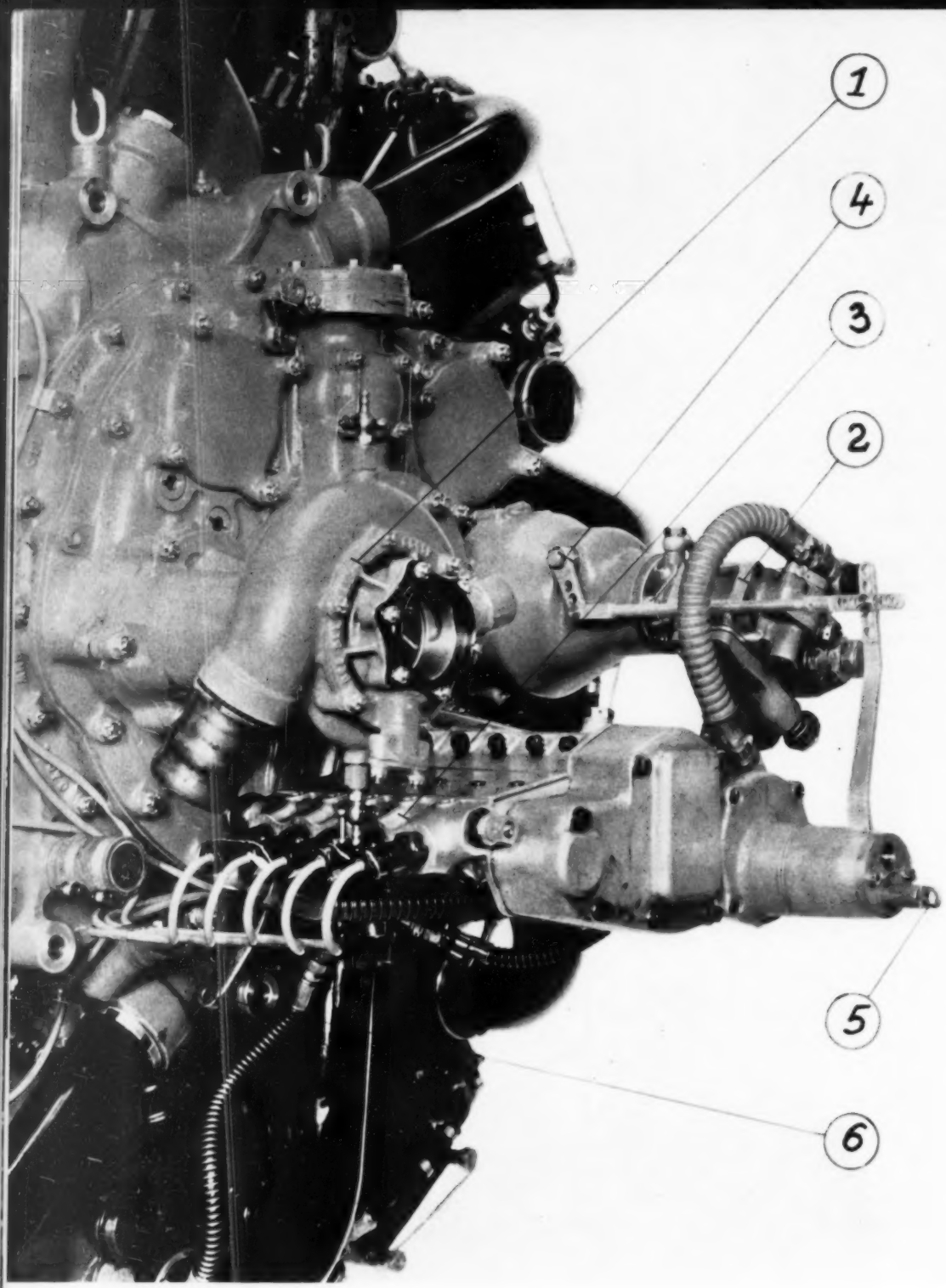
Subsequently, a larger cylinder of 6.10 in. bore and 6.38 in. stroke was used. This had a displacement of 183 cu. in., and from it an output of 45 hp. at 2,200 rpm. was obtained, with a B.M.E.P. of 86 lb. per sq. in. Supercharging at a pressure of 3.83 lb. per sq. in. increased this output to 60 hp., and with 7.1 lb. air pressure an output of 93 hp. was attained. The temperature of the Prestone used did not exceed 248° F. in the supercharged engines of this capacity.

When the complete, nine-cylinder liquid-cooled engine was built and tested, it gave eqnally satisfactory results. Using the comparatively low supercharging pressure of 1.67 lb. per sq. in., an output of 530 hp. at 1,960 rpm. resulted, with a B.M.E.P. of 125 lb. per sq. in. and a fuel consumption of 0.33 lb. per hp. per hour.

The nine-cylinder air-cooled B.M.W.-Lanova Diesel uses a cylinder with a displacement of 183 cu. in., which makes its total displacement 1,647 cu. in. During a six hours' continuous test run at 1,930 rpm., an output of 505 hp. was obtained with a fuel consumption of 0.37

Front view of the new B.M.W.-Lanova 114-V4 liquid-cooled aircraft Diesel. The six small radiators are connected in series, and there is also a small oval oil radiator.





Items of interest at the rear of the engine.

(1) *Centrifugal water pump.*

(2) *Fuel transfer pump.*

(3) *Bosch nine-unit fuel injection pump.*

(4) *Idling control.*

(5) *Fuel throttle control.*

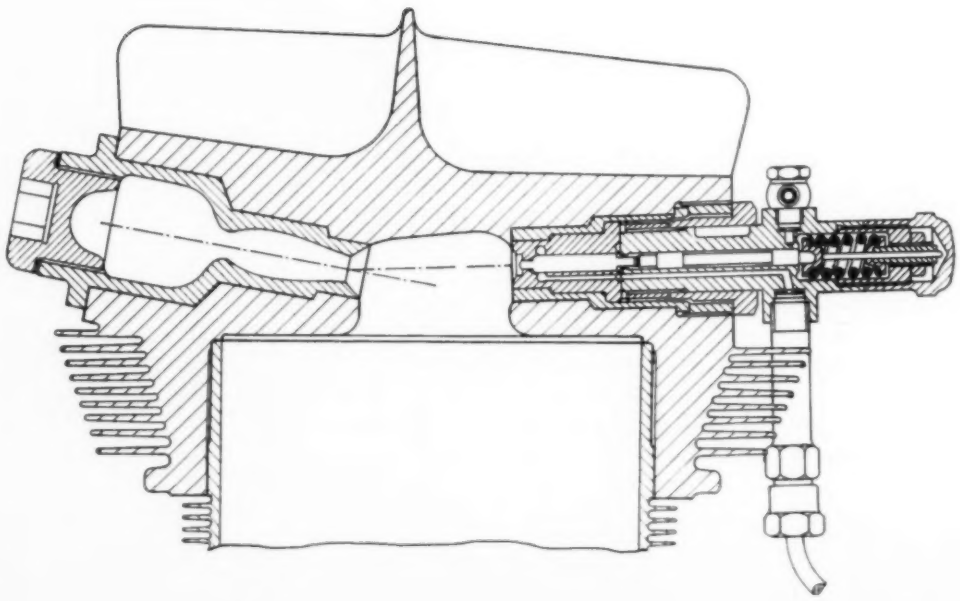
(6) *Injection timing control.*

lb. per hp. per hour. When run for five minutes at full throttle at 2,050 rpm. (as during the take-off of an airplane and its initial climb), an output of 615 hp. at 2,050 rpm. was the result. These tests, which were run with a supercharging pressure of 2.82 lb. per sq. in., showed an output of 22 hp. per liter and a B.M.E.P. of 138 lb. per sq. in. This is equivalent, at an engine weight of 1,058 lb., to a specific weight of 1.76 lb. per hp.

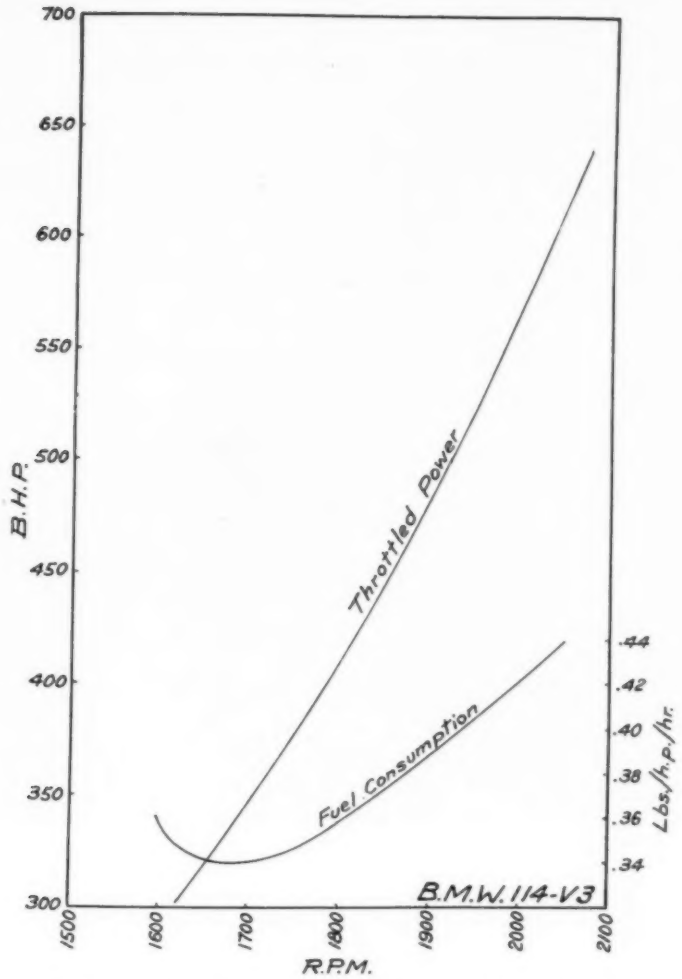
Reliable performance, rather than low fuel consumption, was the primary object of these tests. The cooling fins on the cylinders were of 1934 design but since then, by improving their shape and increasing their area to conform with those used on present-day gasoline engines, considerably greater power and lower fuel consumption than are reported here have been obtained.

The B.M.W.-Lanova 114-V4 liquid-cooled Diesel has a bore and stroke of 6.14 in. and 6.38 in. respectively, and a total displacement of 1,692 cu. in. It develops 650 hp. at 2,200 rpm., and has a total weight of 1,058 lb., or 1.63 lb. per hp. Its compression ratio is 14.8:1, and it has a B.M.E.P. of 138 lb. per sq. in. at its rated engine speed. For cruising, it develops 520 hp. at 2,050 rpm., and has a fuel consumption of 0.37 lb. per hp. per hour. It is approximately 54 in. in diameter and, like all B.M.W. aircraft engines, it operates on the four-cycle principle.

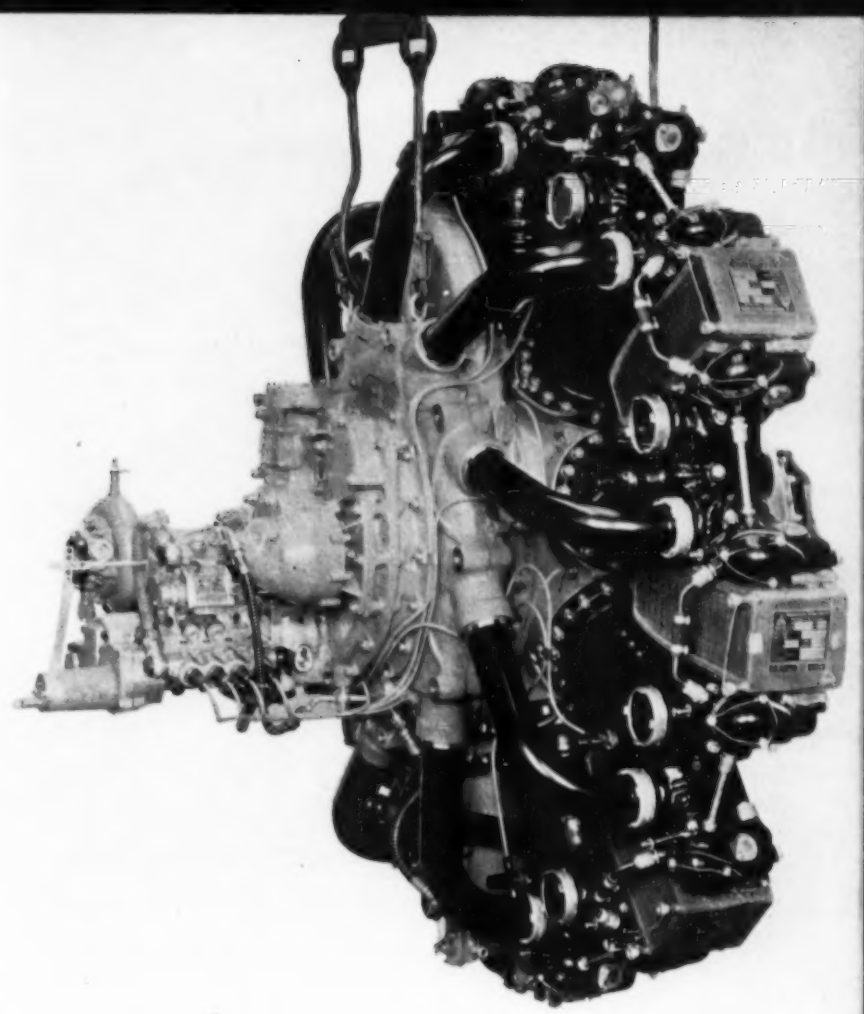
Most of the major parts used in the engine, with the exception of the liquid-cooled cylinders, are based on B.M.W.'s experience with the "Hornet" gasoline engine. The latter is now known as the B.M.W. 132 Dc and is rated at 870 hp., so their new Diesel should soon have a power output of this magnitude. Peak pressures in gasoline engines are fast approaching those in the Diesel, so there is little difference in the strength of the parts or their



Sectional view of the Lanova combustion head used on the B.M.W.-Lanova Diesel. Note the new design of pre-combustion chamber with its twin air cells in tandem.



Power output and fuel consumption curves of an earlier engine, the B.M.W.-Lanova 114-V3 liquid-cooled aircraft Diesel.



Rear view of the B.M.W.-Lanova 114-V4 Diesel. Built into the rear of the engine is a gear-driven centrifugal supercharger which is connected to the inlet valves by manifolds in the conventional manner.

weight. A point of interest is that there are two shallow pockets in the top of each piston head in the new Diesel, directly underneath the valves, to provide better turbulence in the cylinder and to assist in the scavenging. There are two valves in the cylinder head, one for inlet and the other for exhaust, inclined at an angle of 30° from the vertical and operated by enclosed push rods and rocker arms in the usual way from special cams.

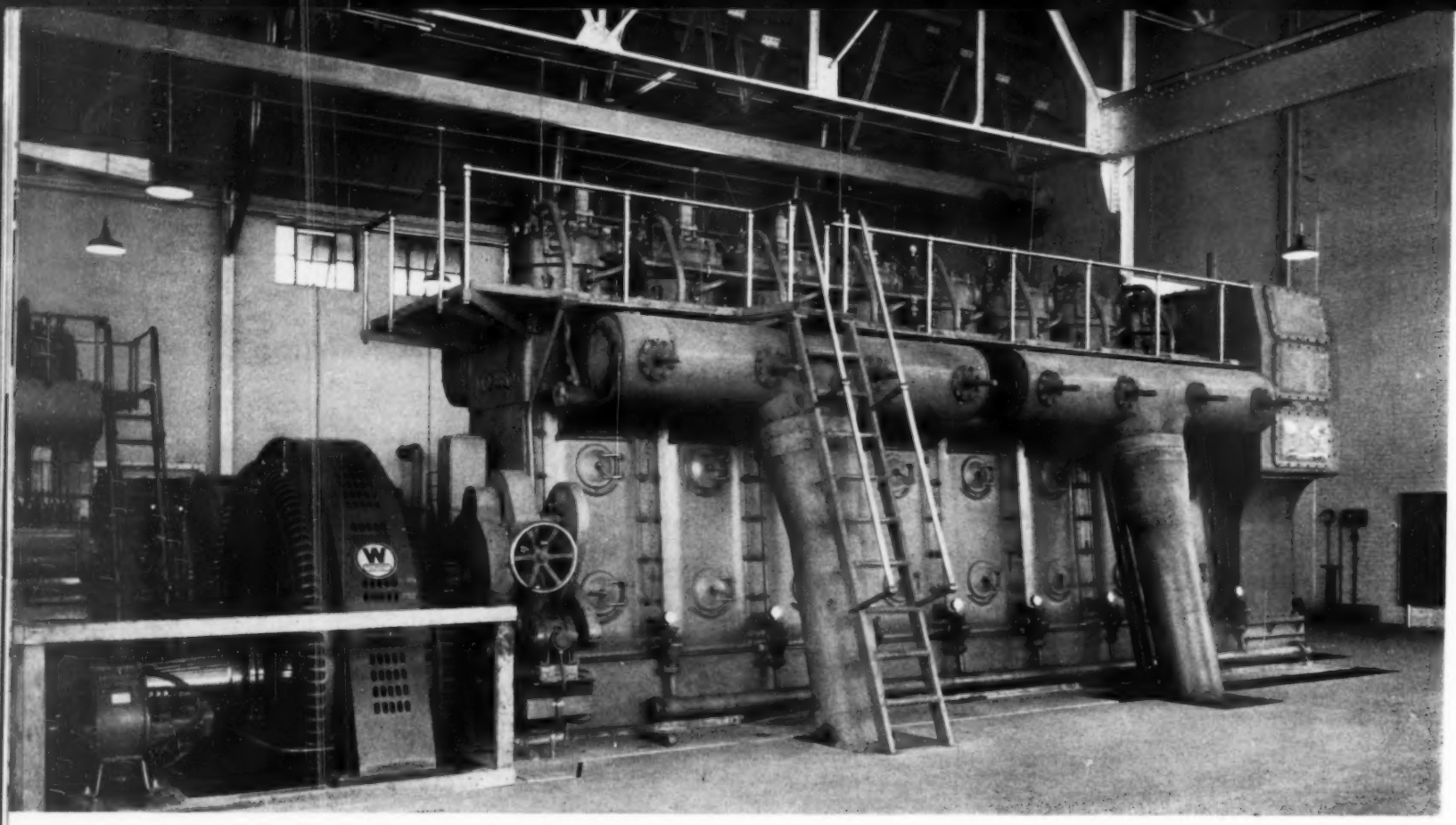
The fuel injection system comprises a special Bosch pump mounted horizontally at the rear of the engine, with five pump units on one side and four on the other. A Bosch fuel injector of the pintle nozzle type is mounted in each cylinder head, and an injection pressure of 1,600 lb. per sq. in. is used. No glow plugs are required, as the engine can be started readily in the conventional manner with electric or cartridge starter.

The new liquid-cooled engine embodies a number of novel features, one of the most striking being the use of six small radiators, of Behr manufacture, between the cylinders. This is made possible by using Prestone as the coolant, as the radiators are much smaller than those which would be required for a water-cooled engine of the same size and power. Their location in this manner, where their plumbing is short and they do not increase the frontal area of the engine, would appear to have great possibilities for quick installation.

The Lanova combustion system with which the new B.M.W. engine is equipped needs little introduction to the engineering world, particularly in the field of Diesel engineering where its principles are so well known and it is so extensively used. A feature on the new engine, however, is the precombustion chamber or "energy cell" of double chamber design, which is claimed to be particularly effective in conjunction with the valve-in-head arrangement used. The shape of the combustion chamber remains in the form of the figure "8," which has given such excellent results in the Lanova system in the past.

Although a nine-cylinder radial is considered by B.M.W. to be a satisfactory engine, it is not their final objective by any means. Multi-cylinder designs, with fourteen and even eighteen air-cooled cylinders arranged in two rows around the crankcase, are considered to be more desirable. The fourteen-cylinder engine would have a displacement of 2,563 cu. in. and a power output of at least 900 hp. at 1,945 rpm., while the eighteen-cylinder design would be a 2,226 cu. in. engine developing about the same power at 2,200 rpm. The B.M.E.P. in both cases is 142.5 lb. per sq. in., and it is estimated that the eighteen-cylinder engine would weigh 1,455 lb., or 1.61 lb. per hp. These engines are the next step in B.M.W.'s extensive aircraft Diesel development program.

So far, the results obtained on the test stand and in the air show that a high state of development has been reached with regard to working pressures, piston speeds, overload pressures and controlled combustion in the B.M.W.-Lanova Diesel. Credit must also be given in no small measure to the Lanova combustion system which has made possible these excellent results.



New Nordberg 2-cycle solid injection Diesel, installed 1938.

GREENVILLE, TEXAS

By ORVILLE ADAMS

THE recent installation of the new 2,000 hp. Nordberg Diesel engine by the Greenville, Texas, municipal plant places the capital of the Blackland belt at the head of the list of money-making Diesel installations in Texas, as well as one of the largest in installed horsepower. The new engine is similar to the engines installed five years ago, having the same bore and stroke, with practically all parts interchangeable. A new $50,000 extension of the power plant building has been added to house the new unit.

According to the officials, the City's Diesel plant is the municipality's greatest asset and source of revenue. In support of this claim, two facts are pointed out. First, the citizens enjoy the cheapest power and light rate of any city of its size in the state. Second, the earnings have been sufficient to pay for the two original Diesel engines in five years. Coupled with this, the plant has earned an average of $100,000 a year in net profits which have been added to the general fund and used to gradually reduce the bonded indebtedness of other departments of the city not incurred by the electric department.

In this connection, it was pointed out that while the indebtedness of many Texas towns increased during the depression years, the indebtedness of Greenville was reduced from $1,750,000 to $1,250,000 since the installation of the Diesel engines. Moreover, the bonds of the City of Greenville have increased in price from $.80 on the dollar early in the depression to a point where they now command a premium. The recent issue of $110,000 in revenue bonds, bearing only 3½ per cent interest was sold at a premium to yield only 2¼ per cent, which amounts to a considerable saving. This new issue are short term bonds (to be paid out of the revenue at the rate of $3,000 monthly) and were issued to pay for the new engine.

Figures recently issued by Mr. T. S. Mitchell, the Commissioner of Utilities for the City of Greenville, are now available on the operation of the municipal plant for the fiscal year ending April 9, 1938, which show that the plants have turned over to the city's general fund the sum of $68,216.17 after setting aside a reserve for a depression fund of $26,400, retaining in the operating fund the sum of $8,741.85 and paying on the amortization of the Diesel engine notes, now paid in full, the required sum of $21,596.94. In connection with these figures, Mr. Mitchell calls attention to the amount of free service rendered to other departments of the City, such as street lighting, the lighting of the schools, parks and municipal buildings, a savings to the City estimated at around $25,000 a year, which sum would be necessary if this had to be paid for by the City in cash.

According to the local daily paper, Greenville's municipal plants have demonstrated their worth; in fact, says the Greenville *Morning Herald*: "The day may not be far distant when

they will absorb practically all of the city's tax burden." The editor of this paper thinks that a continuation of the present policy means "that ultimately the City of Greenville may not have a dollar of bonded indebtedness, since the earnings of the municipal plant are increasing rapidly every year, and may eventually wipe out the bonded indebtedness." Every citizen is kept fully informed by a loyal local press as to the growth and progress of the City's Diesel plant, the City audit being published in full with appropriate editorial comment each year.

For fifty years, Greenville has operated its own power and light plant, prior to 1933, the power being furnished by steam turbines. The cost of operation of the light and power plant, as well as the water works increased to a high point at that time. In that year, two Nordberg Diesel engines, one 1,000 hp. and one 1,500 hp., were installed to take over the major part of the load then furnished by the turbines which were used for peak load operation after the installation of the Diesels.

After the Diesel installation, with increased efficiency and economy and hence lower rates, consumption of electric power increased steadily, amounting to more than 50 per cent in five years, during which the annual production increased from 5¼ million kilowatt hours in 1933, to 7¼ million kilowatt hours in 1938. While part of this increase was anticipated when the first two Diesel engines were installed, the result was that the total amount to be generated by the steam turbines was more than anticipated, the cost for the steam load generation having increased from $2,021 in 1935 to $15,258 by 1938, being as high as $6,798 in 1937. Because the total peak exceeded the capacity of the Diesel engines, the cost commenced to increase.

Analysis of these figures early in 1937 indicated the trend of affairs, so that more than a year ago, the need for another Diesel engine and the elimination of the turbines was clearly apparent.

Immediately after these facts became evident, the City called for bids (early in 1937) for a new Diesel engine, which was purchased in June of last year. In addition to the new engine, approximately $50,000 was spent for enlarging the power plant building to accommodate the new engine and future units. It is easily seen that the operation of the new engine should result in immediate savings as a result of eliminating the steam turbine, and the rate of increase indicates the need for provisions for additional engines in the near future.

COMPARATIVE OPERATING STATEMENT

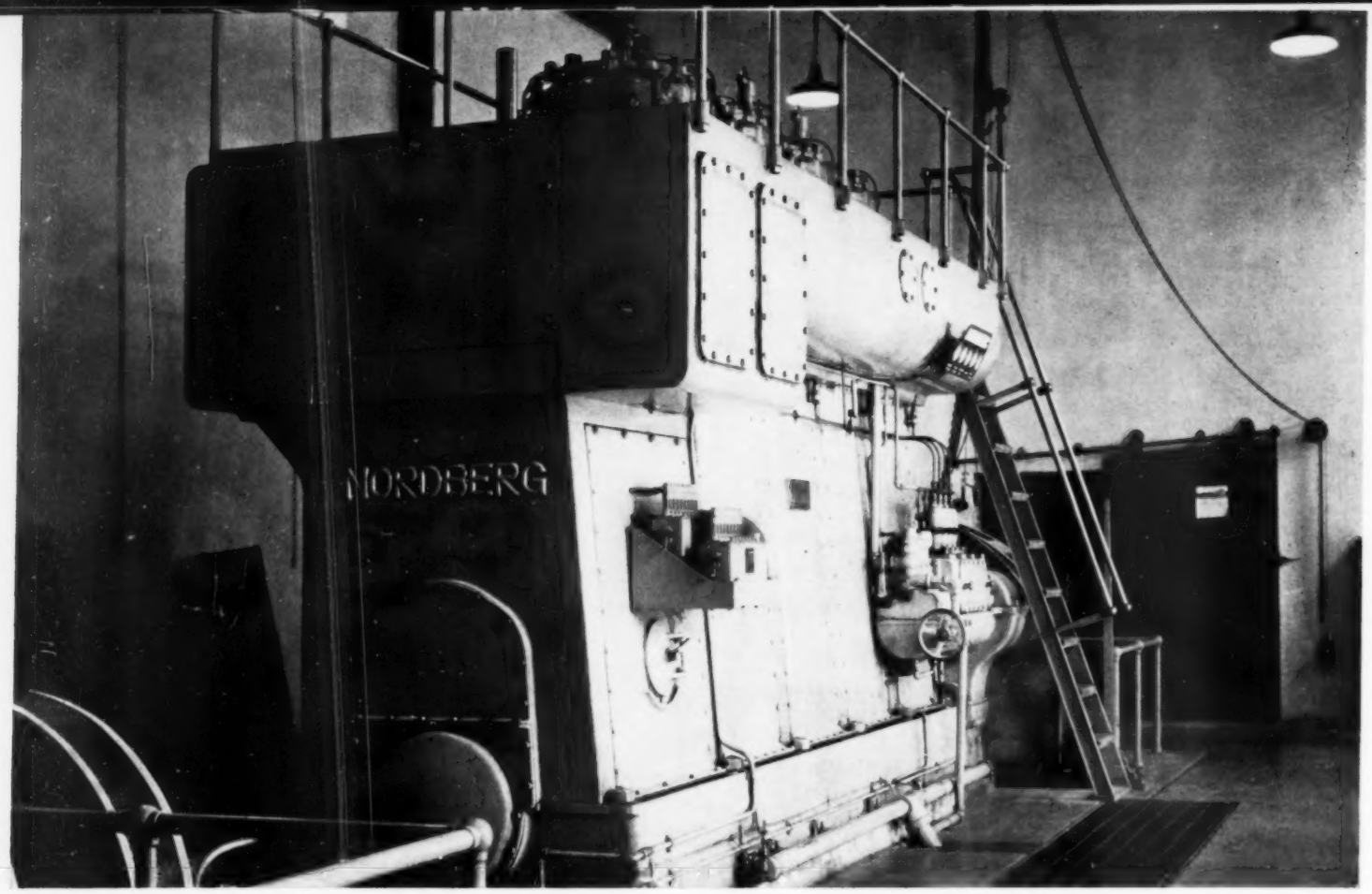
ELECTRIC DEPARTMENT

Revenue:	1937-38	1936-37	1935-36	1934-35	1933-34
Metered Sales—lights	$126,385.25	116,991.59	$104,100.13	$95,826.53	$92,346.12
Metered Sales—power	70,264.01	68,788.92	58,436.47	55,477.84	50,596.43
Municipal water pump	7,218.00	7,148.03	6,930.66	7,107.05	3,138.01
Miscellaneous sales	145.13	12.90	219.81	229.81	340.26
Total Revenue	$204,012.39	$192,941.44	$169,687.07	$158,641.23	$146,420.82
Operating Expenses:					
Diesel Generation	$31,727.18	$25,080.56	$20,090.76	$24,860.12	$5,532.30
Steam Generation	15,258.48	6,798.27	2,052.02	2,021.17	53,431.23
Distribution Expenses	23,014.75	22,434.57	18,657.24	16,732.41	16,610.22
General & Adm. Expenses	9,057.02	8,403.66	10,083.03	8,597.53	7,985.29
Total Operating Expenses	$79,057.43	$62,717.06	$50,883.05	$52,211.23	$83,559.04
Net Operating Income	$124,954.96	$130,224.38	$118,804.02	$106,430.00	$62,861.78

Recapitulation Showing Disposition of Earnings

Transfer to City General Fund	$68,216.17	$73,540.21	$61,287.68	$54,872.00	$32,950.00
Reserve for Depreciation	26,400.00	19,200.00	19,200.00	16,200.00	13,200.00
Retain Operating Funds	8,741.85	8,688.11	9,520.36	6,562.08	2,313.82
Paid Engine Notes	21,596.94	28,796.06	28,795.98	28,795.92	14,397.96
Total Earnings	$124,954.96	$130,224.38	$118,804.02	$106,430.00	$62,861.78
Kwh. Generated	7,250,211	6,471,750	5,681,201	5,303,490	5,281,110
Steam	530,101	212,976	10,480	30,940	2,926,020

New building, Greenville, Texas, municipal electric plant.



1,000 hp. Nordberg Diesel, Greenville, Texas.

The new extension to the power plant building is of modern brick and steel construction, well lighted, and has ample provision in space for additional units, installations which may become necessary within two or three years, based on the assumption that the load rate of increase will continue as during the past five years. The present capacity of the plant, totaling 4,500 hp. in three Diesel units, is barely sufficient to handle the peak load with standby capacity. An additional increase in output per year of one-half million kilowatt hours and as much as 500 hp. in peak load requirements will indicate the need for an additional engine. It is said that the City is fully warranted in anticipating such an increase for several years, and therefore, ample provisions were made in the construction of the new building by allowing space for additional units. The basement type of installation was employed, and removable columns support a section of the floor so that a new foundation could readily be constructed without any changes in the building.

The new installation, like the previous engines, is fully equipped with essential auxiliaries, including air filters, oil coolers, centrifuges, pyrometers and exhaust silencers. An American air filter assembly is installed in a brick and concrete housing shown in the photograph. The engine is regulated by a Woodward governor, and the temperature of the exhaust is indicated by an Alnor pyrometer. Centrifugal purification of the lubricating oil is provided by a DeLaval centrifuge.

The engine is directly connected to a Westinghouse alternator with V-belt driven exciter, and a new and improved switchgear of the deadfront type has been installed. A large overhead runway and crane, sufficient for handling the heaviest loads, is part of the new building. In the basement are located the oil and fuel handling equipment, including coolers, pumps, centrifuges and all piping, electric wiring and the like. Only the switchboard is on the engine floor level, as well as a rack for essential engine tools. The arrangement and layout of the engine represents the best in modern power plant construction and operating practice.

The operating routine and general maintenance is under the direction of a chief engineer and a corps of operators; the control of the operation is by means of an hourly log sheet reflecting the best in modern practice, efficiency and thoroughness.

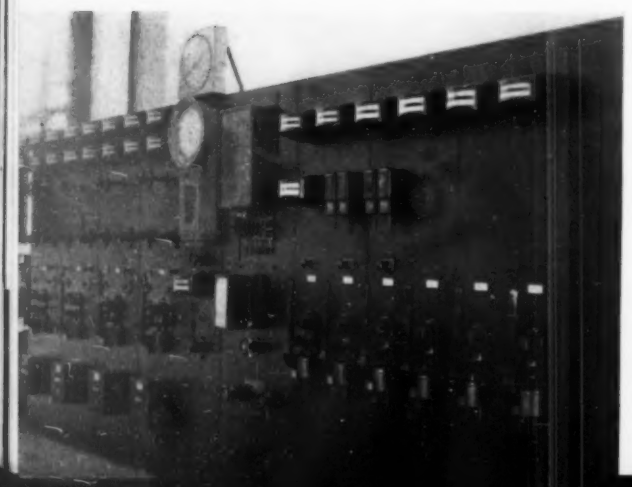
The fuel oil used comes from the vicinity of Gainesville, Texas, and is what is known as a blended oil, containing approximately 40 per cent boiler fuel oil and 60 per cent gas engine oil. The blended product weighs 7.152 lb. per gallon. The acceptance test made on the new engine using this oil shows the following results as compared with the guarantee.

Load	4/4	3/4	2/4
Guaranteed fuel consumption per bhp.	.39	.40	.43
Tests for acceptance	.3830	.3825	.3911

Mr. T. S. Mitchell, who furnished the writer these data, is well pleased with the results of the test for fuel consumption and the general economy of operation of the engine. Over a period of several weeks of continuous operation, the general consumption data on the engine were found to be well in line with the above data.

The engines are of the solid injection, two-cycle type with scavenging pumps. The general maintenance cost has been very low on the two original units, although they have operated almost continuously throughout the year. The attached table showing operating data, maintenance, operating cost and other factors, bears out this fact.

New switchboard, Greenville, Tex., municipal Diesel electric plant.



"CHARLOTTE"—STERLING POWERED

By GEORGE D. CROSSLEY

THE Diesel-engined yacht *Charlotte*, owned by Mr. Morris Steinberg of New Orleans, typifies the type of yacht in which the new Sterling crankless Diesel engine is being installed.

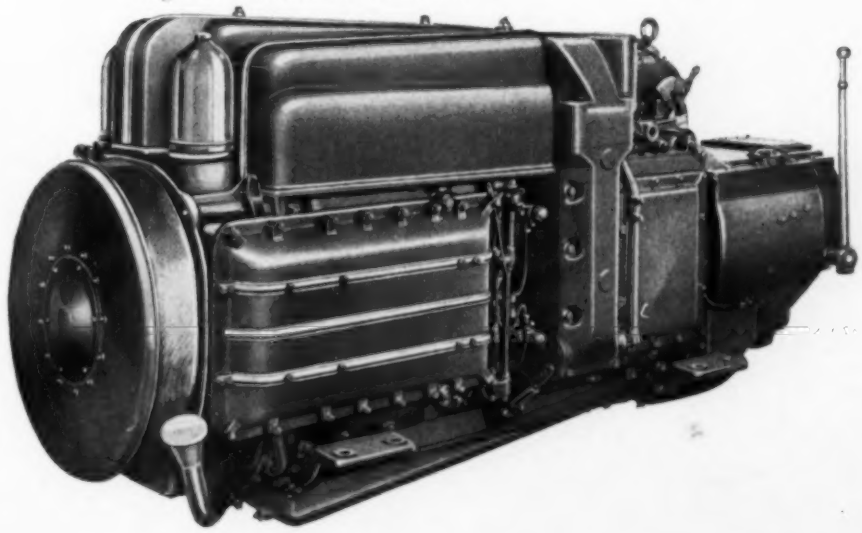
The *Charlotte* was designed and built by the Higgins Industries, Inc., of New Orleans and is of unusually heavy construction: the keel and all longitudinal members are in one length, without scarf or butt; framing is unusually heavy and on very close centers. The boat is stable and handles well in any kind of sea. The draft is suitable for use in Louisiana bayous and shallow rivers, being only 34 in.: design of the hull is such that there is not an objectionable bow wave and boat does not drag a stern wave. This is convenient for running through bayous and canals that have other boats tied up along the bank.

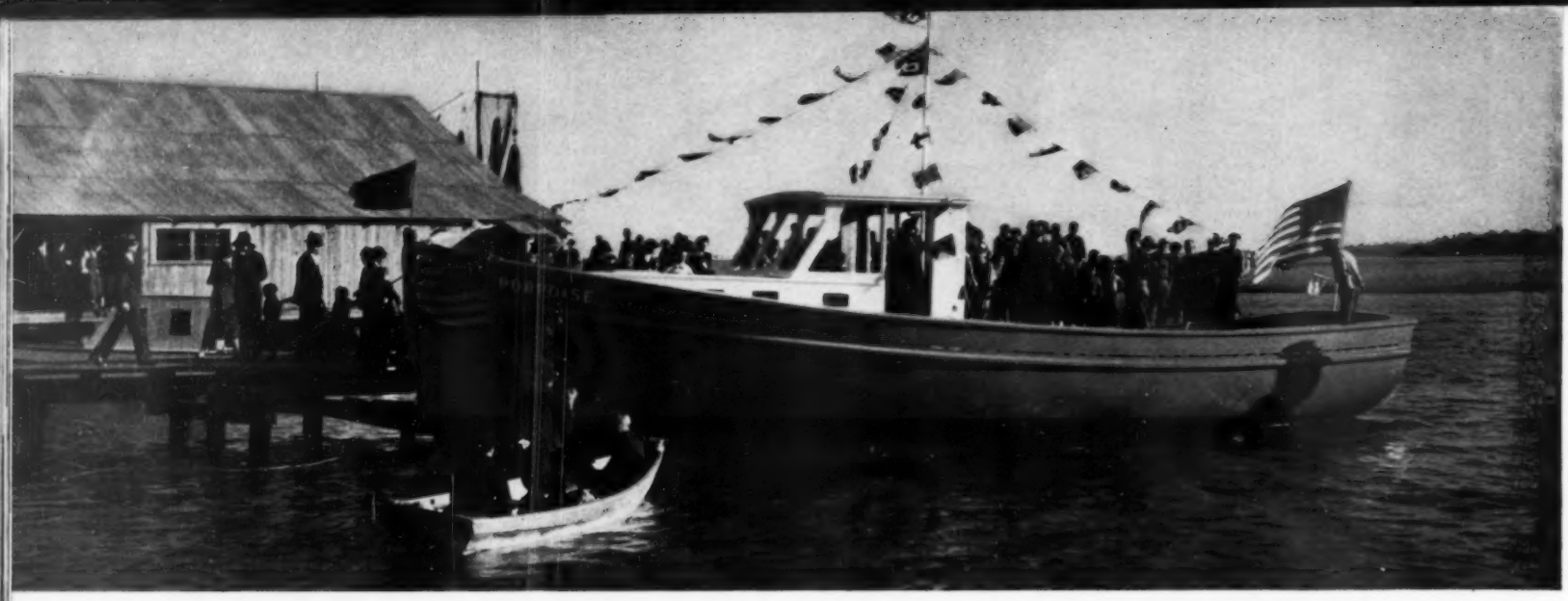
Due to development of the bottom design, this boat has remarkable maneuverability, back up and control. Another innovation is there are no exposed carlins: the ceiling is smooth; the entire skin and ceiling are ventilated. People on the bridge deck or on the after deck, or any part of the boat can converse in moderate tones, not disturbed by engine noises or vibrations, and thus get complete and proper relaxation in the use of the boat. The engine performs perfectly; although boat is of heavy construction and heavily appointed, a cruising speed of 13 mph. is obtained.

Aside from the simplicity and smoothness of operation, the salient feature of the 150 hp. Sterling crankless Diesel engine is the fact that it is the only Diesel with large hand holes on the side, which, when removed, permit the withdrawal of the eight pistons and all the internal working parts.

The commodious character of accommodations on the "Charlotte" are typified by the bridge deck illustration above.

Below is a quartering view of the 150 hp. crankless Diesel engine installed in the "Charlotte."





A throng of admiring guests inspect the Porpoise after her christening by Mrs. Fred P. Cone, wife of the Governor of Florida.

DIESELS BRING 'EM BACK ALIVE

The Buda Diesel Powered "Porpoise" Serves as a Supply Boat for America's First Miniature Ocean

THE two largest individual aquaria ever built and the world's only specially designed underwater motion picture studio will soon be opened by Marine Studios at Marineland, Florida, eighteen miles south of St. Augustine and thirty-five miles north of Daytona Beach on the new Ocean Shore Boulevard. There two large tanks are being constructed as "Oceans in Miniature." In these, large and small fish and aquatic mammals will be presented just as they are found in their natural surroundings, under conditions duplicated nowhere else in the world. A twin screw Diesel vessel will be used to secure many of the specimens for this unique project.

These aquaria, the result of patient, pioneering effort, employ a wholly new principle of presenting sea life. Instead of the usual aquarium method of displaying each species of fish in its own small compartment, Marine Studios will present in each of its huge tanks a facsimile reproduction of submarine life in which each species will play the same part that it does in the ocean. This method of presentation provides the average visitor and the scientist an ideal opportunity to observe, photograph and study the various types of fish and aquatic mammals.

This is an enterprise representing an investment of approximately $500,000 launched by a group including Messrs. Cornelius Vanderbilt Whitney, Nicholas S. Ludington, Albert G. Redpath, Sherman Pratt, Blake Lawrence. Ward Cheney, all of New York, and Ralph H. Poole, Jr., of Chicago. W. Douglas Burden, a trustee of the American Museum of Natural History, originally conceived the basic idea be-

Stern and bow views of this unusual Diesel vessel before launching. Note the trap door which permits the fish tank access to the sea from the interior well.

Throughout its development, the aim has been to create a national institution combining hind the project and is now its directing head. sound scientific and educational values with the recreational appeal which lends them flavor.

Marine Studios will make every effort to duplicate, so far as circumstances allow, conditions existing in the open sea. For example, a coral garden will be built right in the tanks. The highly colored coral fish will be obliged to seek safety from the enemies just as they normally do in the open sea by escaping in among the interstices of the coral growth where the larger carnivores cannot follow.

Various sea grasses and sea weeds will grow from the bottom of the tanks thereby increasing the beauty of the scene and affording protection for certain small forms such as the pipe fish. Jelly fish will float near the surface accompanied by their camp followers, the tiny fish that derive safety from their stinging tentacles. Lobsters, an octopus, and perhaps an eleven-foot spider crab, and other bottom feeders will be seen from the lowest row of portholes.

Capturing alive and transporting the larger species which will be placed in these tanks presented certain problems which had to be solved before the project was feasible. Extensive research has developed a method of injecting a drug through a hypodermic needle into the largest sharks, porpoises, giant rays, etc., which puts them to sleep almost instantaneously.

To handle and transport these fish and aquatic mammals a special Diesel boat was designed and built. Recently launched and christened the "Porpoise" by Mrs. Fred P. Cone, wife of the Governor of Florida, this boat is now equipped for capturing and bringing back alive the specimens for exhibition at Marineland. It is constructed entirely of wood and resembles a shrimp boat with a water tight well in its hull which opens into the sea through a trapdoor.

In its center a metal tank is placed on rollers, so that it can be easily lowered through the trapdoor in the stern of the hull into the water where the fish, under the temporary influence of the anesthetic, is manoeuvered into the tank and pulled back into the boat, entirely without injury. On reaching the shore this metal tank is transported by crane and deposited in a flume until the fish has completely regained consciousness, before being placed in the appropriate aquarium.

The "Porpoise" is 48 feet overall with a 16 foot beam and 3 foot draft. To permit several days' activities at sea without return to port there are sleeping accommodations for four persons below decks, two in the forecastle and one in the pilot house. Power is furnished by twin Buda Diesels of 110 hp. each which drive Columbian Bronze propellers through Morse 2.45 : 1 reduction gears and Twin Disc clutches. Maximum and cruising speeds are 13 and 10 miles per hour respectively with a cruising radius of 1000 miles at the latter. Since the live fish will be taken from the Gulf Stream and prolonged searching for particular specimens will be necessary upon occasion, the extra cruising characteristic of Diesels is of paramount importance. During extended periods at sea, the "Porpoise" will operate in conjunction with speed boats which will transfer "catches" to the tanks on shore thus eliminating loss of time between fishing grounds and the shore base. Mr. E. B. McCrohan, N.A. of New York is responsible for the design of the "Porpoise," which is captained by Eugene Williams and Ilia A. Tolstoy, grandson of Count Leo Tolstoy, the famous Russian writer.

In addition to the specially designed and constructed Diesel boat for securing live fish heretofore not taken uninjured, the method by which Marine Studios will afford its visitors a unique opportunity to study marine life centers around the construction of the tanks themselves. One tank is rectangular, 100 feet long, 40 feet wide and 18 feet deep; the other tank is circular, 75 feet in diameter and 11 feet deep. Enclosed galleries run at different levels around the entire perimeters of the two tanks. Each of the galleries faces inward upon a circle of glass portholes, of which there are 200 in the sides and bottoms of the inner tanks where the marine life is displayed.

Each observer—layman or scientist—can sit in his comfortable chair and look into the naturally lighted tank through his individual porthole in much the same manner that he looks upon the lighted screen at his favorite movie theatre. Thus the visitor enjoys the exhibits without the usual distractions present in the ordinary museum or aquarium where the number of lighted cases or objects on display and the moving crowds distract the mind and prevent easy concentration and relaxation.

View of one of the twin 110 hp. Buda Diesels with Pierce governors.

The portholes are placed in such a way as to make it possible for observers to look into the tanks from four different levels—from the bottom of the tanks looking upward, from the sides at a level just *above* the bottom of the tanks, from the sides just *below* the top of the tanks, and from an open galley around the top of the tanks.

The design of the tanks was recommended by technical motion picture experts who with the greatest care worked out in advance the various camera angles that would be necessary to afford producers the maximum latitude in the filming of scenes.

Architect's sketch of Marineland: The sea, the "Oceans in Miniature," surrounding ground and the yacht basin which connects with Florida's inland coastal waterway.

THE OYSTER DREDGE "SEAWANHAKA"

By B. J. VON BONGART

OYSTER fishing is one of Long Island's oldest industries and the town of Oyster Bay — where the late President Theodore Roosevelt was "at home" — was so named because of the oysters abounding there.

But, oyster fishing has given way to dredging thanks to the Diesel engine. Whereas formerly the oystermen raked the bottom of shallow waters to secure the luscious sea food, today's practice, as exemplified by the Oyster Bay Oyster Company, consists of dredging, i.e., drawing the oysters from their natural abode by means of suction pumps and nozzles. The latter are not unlike huge vacuum cleaners and are traveling over the ocean bed on airplane wheels and balloon tires. The nozzles are over 8 ft. in width, they are swung over the side of the hull together with the suction pipe by means of derricks, and the moving boat drags the huge suction nozzles over the ocean bed.

Dredging is done at a speed of about three knots per hour and it is estimated that the oyster bins of the *Seawanhaka,* holding 5,000 to 6,000 bushels of oysters, may be filled within but two hours of dredging. The more conventional dredgers as used today have a capacity of from 1,000 to perhaps 1,800 bushels of oysters and they are not as efficient in dredging as the *Seawanhaka,* hence the latter does the work of at least three dredgers of the customary type.

Since the oyster bins are on the forward deck, the pilot house, crew's quarters and galley being a superstructure occupying the aft portion of the deck, the entire hull proper is used for housing the Diesel engines and the machinery. The main propulsion engine is a Fairbanks-Morse 500 hp. 5-cylinder Diesel of 12 in. bore and 15 in. stroke with pump scavenging, delivering its rated power at an engine speed of 400 rpm.

The engine is controlled from the pilot house and is, of course, direct reversible.

There are also two auxiliary Fairbanks-Morse Diesels of 8¾ in. bore and 10½ in. stroke, delivering 120 bhp. at an engine speed of 450 rpm. These engines, too, are pilot house controlled and each engine is coupled, by means of clutches, to a centrifugal dredge pump which draws the oysters from their bed.

In addition, each of the two auxiliary Diesels may operate salt water pumps for the flushing of the oyster bins and they may also drive 20 kw. D.C. generators to furnish current for the operation of the moving screen, the conveyor belts, the motor-driven steerer, sanitary and fresh water pumps, centrifuge, electric lights, etc.

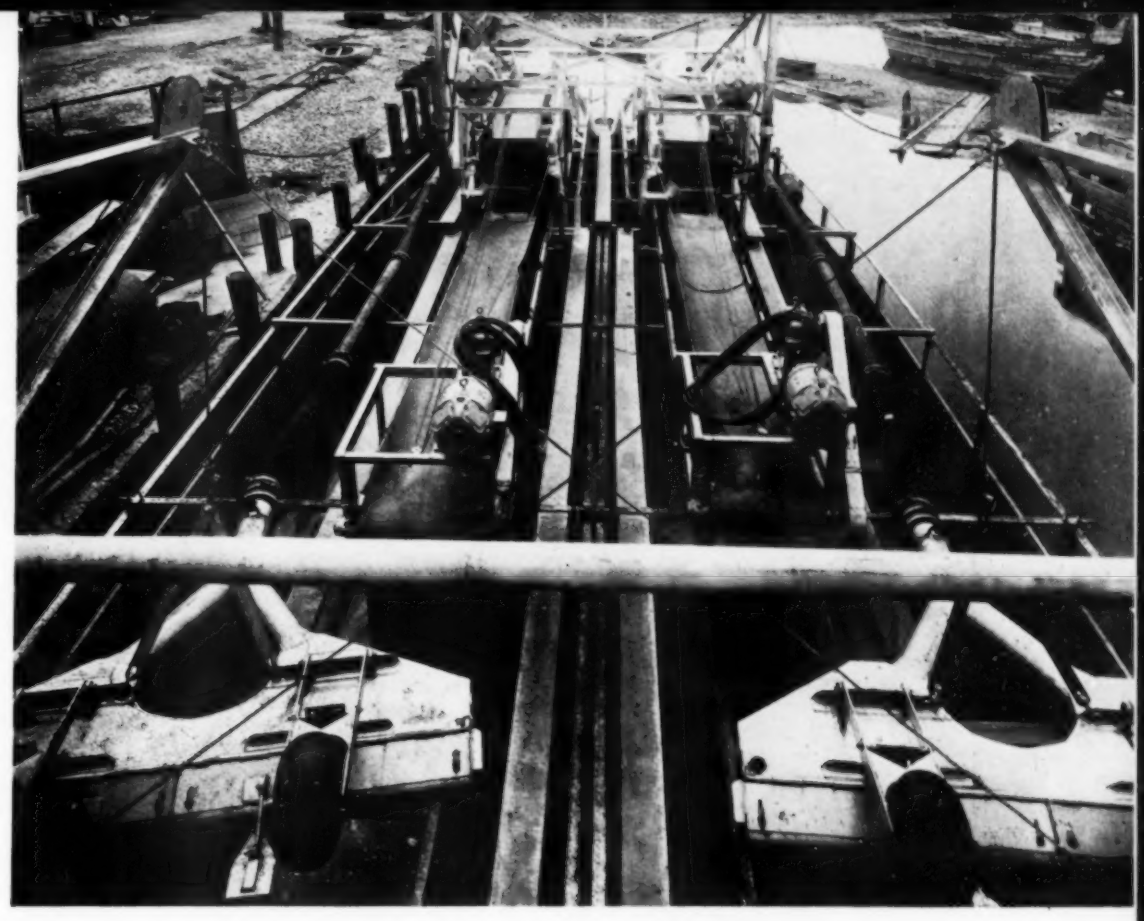
The auxiliary engines, together with the ma-

Left — Engine room of the "Seawanhaka." Two Fairbanks-Morse auxiliary Diesels in the foreground, main propulsion F-M Diesel in rear.

chinery, are mounted forward, starboard and port, the main engine is placed aft. The accessories of the engines are well chosen and complete in every respect. Maxim silencers are used for the air intake as well as for the exhaust gases; Alnor pyrometers are fitted to the cooling water manifolds, the cooling medium being fresh water rather than sea water. The lubricating oil, after passing through coolers, is cleaned by means of a Goulds Hydroil Centrifuge and is further conditioned by four W.G.B.S. clarifiers. The fuel oil is protected from dirt and foreign matter by Nugent oil filters. Vacuum Oil Company lube oil is used, whereas the fuel oil is furnished by the Atlantic Oil Company.

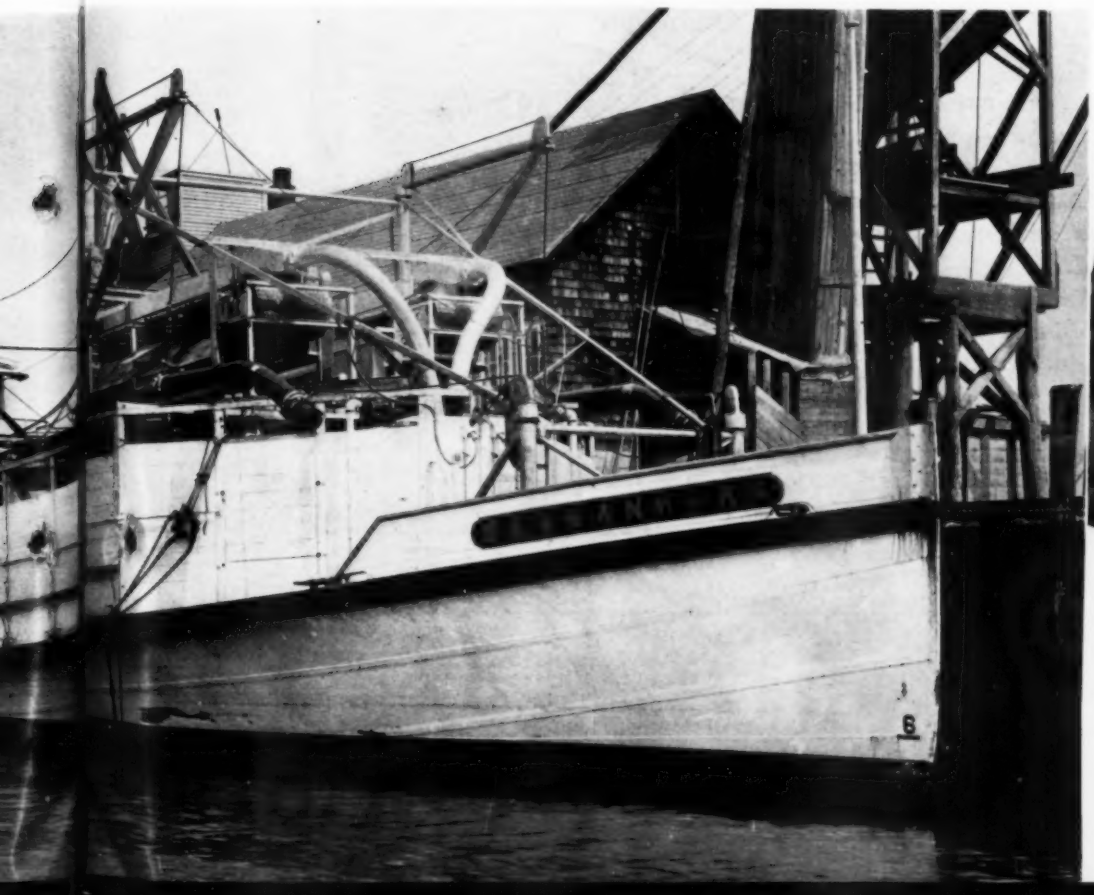
In actual performance, the *Seawanhaka* is a revelation. When the dredging pump is in operation, oysters, mud and whatever happens to lie on the ocean bed, are drawn up and discharged on a moving steel screen. The water washes all mud and refuse through the screen onto the deck below from whence it is washed overboard. The oysters move along with the screen and are finally discharged to a moving conveyor belt, which in turn delivers the oysters, empty shells, starfish and drills (the oyster's natural enemies), also the refuse that may be carried along, into the bin. Here the oysters are sorted and graded and the extraneous refuse is disposed of.

Since there are two complete dredges on board, each independent of the other, the dredging operations may be carried on at will either starboard or port. If, for example, as during the maiden trip of the *Seawanhaka*, dredging is done from starboard, the port Diesel is then used to operate the 20 kw. generator which then furnishes current for the operation of the electric motor-driven screen and conveyor belt and other electrically operated machinery. As a precautionary measure, the *Seawanhaka* also carries a 100 cell 110 volt Edison battery which can furnish light or operate machinery. The battery may be recharged by either of the Diesel-operated D.C. generators.



The dredging equipment of the "Seawanhaka." Note the huge vacuum cleaner type suction nozzles and the balloon-tired airplane wheels.

Messrs. S. Y. Bayles and J. Waldron Bayles (father and son), owners of the Oyster Bay Oyster Company, are blazing a new trail in oyster dredging and it is predicted that their innovation will have far-reaching effects upon the oyster industry. Incidentally, the Diesel engine is not new to them, their oyster boats *Gloria B., Waldron B.* and *W. H. Hoy*, as well as their yacht *Sonse*, are all powered with Fairbanks-Morse Diesels and the faith of the Bayleses in the Diesel engine cannot be shaken.



Main propulsion engine, 500 hp. Fairbanks-Morse.

A spectacular job—building Treasure Island in San Francisco Bay for the 1939 Golden Gate International Exposition. Over a mile long, nearly a mile wide, formed of 20 million cubic yards of dredged sand, 287,000 tons of rock, and 80,000 yards of top loam. Construction materials include 10,000 piles, 30,000 yards of concrete aggregate, 30 million feet of lumber, 5,000 tons of steel, 250,000 feet of wire—a magic city on the world's largest man-made island.

MORE low-cost operating hours! On the world's biggest projects you'll find "RPM" Diesel Engine Lubricating Oil. There's a reason!

With "RPM"—the world's *first* and outstanding discovery in "Caterpillar" Diesel engine lubrication—you get more work done at less cost. It prevents ring-sticking, keeps pistons free from carbon, avoids gummed valves, maintains piston seal—saves operating time and money all around.

Try it in *your* "Caterpillar" Diesel—you'll learn why more "RPM" Diesel Engine Lubricating Oil is used in "Caterpillar" Diesel engines than all other Diesel oils combined.

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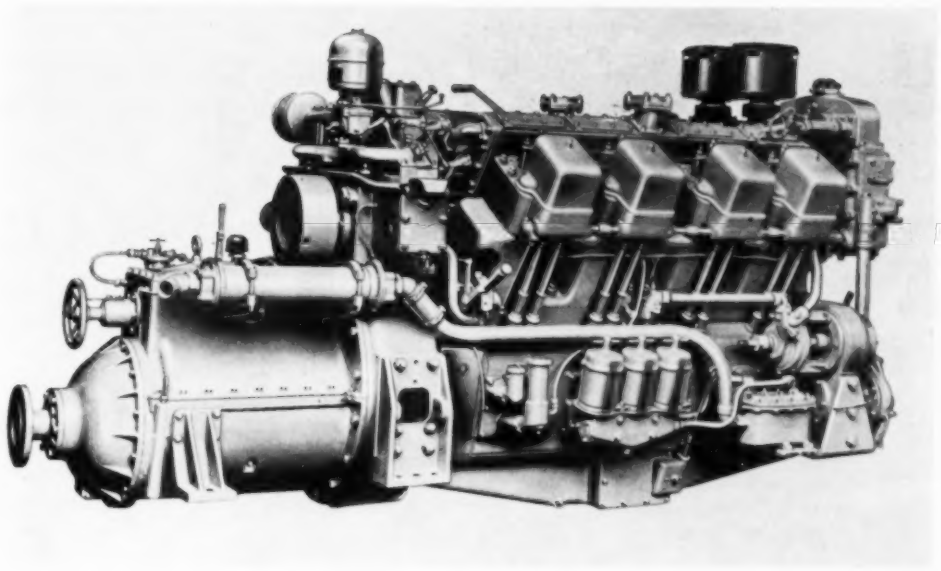
DIESEL ENGINE LUBRICATING OIL

Approved by
CATERPILLAR TRACTOR CO.

STANDARD OIL COMPANY OF CALIFORNIA

"CATERPILLAR" MARINE ENGINE

New Model Announced



A NEW "Caterpillar" marine Diesel engine has been announced by Caterpillar Tractor Co., Peoria, Illinois.

The new engine is a V-8, 135 hp. model, rated for continuous service, which, according to the manufacturer, means 24 hours a day, 365 days a year if desired.

The new engine has a bore of 5¾ in. and a stroke of 8 in. It develops its maximum horsepower at 900 rpm. It is a medium weight engine and especially well suited to the work boat field.

As in the case of other "Caterpillar" marine Diesel engines, the D17000 model features simplicity and ease of maintenance. Both the fuel injection pumps and valves are factory set and require no adjustment in service. Each cylinder employs a separate valve and pump. The valves are pressure operated, employing no mechanical means of opening. Each has a single orifice of comparatively large diameter, through which fuel is sprayed into a pre-combustion chamber. The size of this orifice practically precludes ever having a clogged spray valve.

The engine, with reverse gear, is ready for operation when but five connections have been made. It is only necessary to connect the exhaust to atmosphere, sea water suction to raw water pump, heat exchanger outlet to overboard discharge, fuel oil line to main storage tank, and to align the thrust bearing shaft and connect it with the propeller shaft.

The D17000 engine is ruggedly constructed and designed to handle varying or continuous loads. Because of its inherent simplicity, it can easily be operated by unskilled personnel.

NORTHILL TO BUILD COVIC

AN immediate production program of more than a million dollars' worth of Diesel engines was announced today by John K. Northrup, vice-president of the Northill Company, Inc., prominent Los Angeles manufacturer of equipment for the aircraft and marine industries. This move puts Southern California in the national Diesel production picture and brings to Los Angeles another major industry of rapidly growing importance.

Northill Company has acquired exclusive, national manufacturing and sales rights for the Covic Diesel engine, revolutionary type of power plant that for the first time combines Diesel engine efficiency with weights comparable to standard gasoline motors. Cylinders on the Covic Diesel are horizontally opposed, of the "pancake type," which permits installation in places formerly impossible for Diesel engines. This engine was originally developed in England and thousands are in use throughout the world for marine, stationary and automotive power.

"THOMAS E. MORAN" LAUNCHED

New Type Diesel-Electric Tow-Boat

HAILED as the most modern vessel of its kind afloat, the *Thomas E. Moran*, first of two new tow-boats of the Moran Towing and Transportation Company, New York City, was recently launched at the Defoe Boat and Motor Works at Bay City, Michigan.

"Thomas E. Moran" just before the launching.

The sea-going tug is said to point the way toward a new application of Diesel-electric propulsion in vessels that will have an important effect upon the re-establishment of the American merchant marine because of its economies in construction, weight, operating costs and maneuverability.

Part of the launching party — George W. Codrington of General Motors; Miss Evans, the sponsor; Edmund Moran, the owner, and R. K. Evans of General Motors, father of the very attractive Miss Evans.

The all welded steel hull vessel, which is expected to be put in service in New York harbor within the next month, is powered by two of the new General Motors eight-cylinder, two-cycle V-type Diesel engines. Total horsepower is 1,350. The engines operate a generator that supplies current to a motor, which, through reduction gears, transmits the power to the propeller. The flow of power, with the exception of the reduction gears, is the same as in the high-speed mainline Diesel powered streamline passenger trains now criss-crossing the western half of the United States.

The vessels were designed by Tams, Inc., New York City. For further details refer to pages 38 and 39 of the May, 1938, issue of DIESEL PROGRESS.

S. A. E. NEWS

DIESELS will play the leading role at the Regional Meeting of the Truck, Bus, and Rail-car Activity of the Society of Automotive Engineers, set for October 4 and 5 in Chicago. The meeting is planned largely as a forum where railroad and automotive engineers will discuss mutual problems resulting from the increasing use of Diesel engines in streamliners, trucks, and buses.

* * * * *

The first speaker on the tentative program is E. F. Weber, superintendent of automotive equipment, Chicago, Burlington & Quincy R. R., who will discuss practical problems in the operation and maintenance of Diesel-electric trains. Following this session an inspection trip is scheduled through the plant of the Electro-Motive Corp., where Diesel-electric locomotives for streamlined trains are built. Another railroad man, Walter E. Dunham, general superintendent, Car Department, Chicago & Northwestern R. R., will speak on rail-cars, streamliners, and buses at a dinner meeting. J. B. Fisher, vice-president of Waukesha Motor Co., will compare Diesel, semi-Diesel, and gas power in the final paper of direct interest to Diesel men on the tentative program.

* * * * *

A proposed method of test for the ignition quality of Diesel fuels has been agreed upon by the Automotive Diesel Fuels Division of the Cooperative Fuel Research Committee following a recent demonstration meeting at Wood River, Ill., and a Division Meeting held during the 1938 Summer Meeting of the SAE at White Sulphur Springs. The method selected is called the coincident-flash fixed-delay method and uses neon lights located on the flywheel operated by contact points on the combustion and injection indicators. It has been released for publication by the American Society for Testing Materials, in the Year Book of Committee D-2.

* * * * *

To find the reproducibility of the new method, the Automotive Diesel Fuels Division of the C.F.R. is setting up an Exchange Group for the periodic exchange of fuel oil samples for test at a group of cooperating laboratories.

NEWS

125 DIESEL BUSES

PONTIAC, Mich. — First of 125 Diesel electric coaches for operation in Newark and environs is now being delivered to Public Service Coordinated Transport of New Jersey by the General Motors Truck and Coach Co. of Pontiac.

Four of the coaches arrived recently and attracted unusual interest, as they are the first coaches in the world to be powered with the new General Motors 2-cycle Diesel engines.

The coaches are of the most modern transit type, with the engine and electric generator mounted transversely in the rear.

Ninety-five of the coaches are of 25-passenger capacity with 4-cylinder Diesels and 30 are 36-passenger with 6-cylinder engines.

Public Service, the largest city operator in the country, has for many years pioneered in the development of Diesel electric powered coaches for mass transportation. As early as 1930 the company operated a Diesel driven coach and in May, 1936, purchased 27 such vehicles, the fleet being the first in this country to be equipped with Diesel electric power.

WELDING ALUMINUM

THE Aluminum Company of America, Pittsburgh, Pa., has recently produced a new edition of their very informative book, "Welding Aluminum and Its Alloys." Many of our readers will find this book etxremely valuable. A copy of it may be obtained by writing direct to Pittsburgh and mentioning DIESEL PROGRESS.

NAVY CONTRACT GIVEN TO FAIRBANKS-MORSE

WASHINGTON — The Navy awarded a $567,611 contract recently to Fairbanks, Morse & Co., Chicago, for two complete sets of main propelling machinery and Diesel engine generators for two mine-sweepers to be built at the Norfolk Navy Yard.

112 TRUCK DIESELS

WITH orders to Dieselize the equipment of three of the largest contracting concerns in New York, business with the Cummins Engine

Company, Columbus, Indiana, builders of automotive, marine and stationary Diesel engines continues to boom despite general unstable economic conditions throughout the country.

During the last thirty days, the Cummins Engine Company has received orders for 112 engines for the Colonial Sand and Stone Company, Inc., of New York City, the largest concern of its kind in the United States. Sixty-two were for the four-cylinder model for replacements in old trucks and fifty of the six-cylinder model will be installed in new Mack trucks now being built at the Mack factory in Allentown, Pa.

The fifty new Cummins Diesel-powered trucks were purchased by the New York concern at a cost of approximately $500,000. It is said to be the largest single order ever placed for this type of truck for use in the United States.

Up to two years ago, Diesel powered dump trucks was a comparatively new field for the Cummins Engine Company. Contractors had contended that because of the short hauls usually made by dump trucks, Diesel power would not be economical in proportion to its records on high-speed, interstate freight transfer. However, experiments made by these and other concerns in metropolitan New York City and general contractors on large dam jobs covering periods of a few months to two years, proved the practicability and economy of the Diesel engine for short haul work.

The Cummins Engine Company, a pioneer builder of Diesel engines, is now operating on the largest production schedule in its history and is carrying on an extensive expansion program. Additions to two of the present buildings are being constructed and work on a new factory building, strictly modern, in which nothing but the Cummins Diesel fuel system will be manufactured, is scheduled to start immediately.

P. E. Letsinger, Vice-President in Charge of Sales, states that the Cummins Engine Company plans to double their present production during the next twelve months. This will be due to a new smaller Diesel engine built in four and six cylinder sizes (4 in. bore and 5 in. stroke) which has just started to come off the line. A further improvement in the fuel system eliminates all objectionable smoke and odors which will make the Diesel engine practical for city buses operating in heavy traffic. It is said that at a small cost, the improved fuel system can be adapted to all Cummins Diesels now in service.

The company has operated at near capacity for the past six years, and the present expansion program is its fifth during this time.

ANOTHER BIG ORDER

An order for 125 forty passenger single-deck motor coaches powered with Diesel engines and having automatic hydraulic transmissions has been received by the Yellow Truck and Coach Manufacturing Company of Pontiac, Michigan, I. B. Babcock, president and general manager, announced recently.

Fifty of the buses will be delivered to the New York Omnibus Corporation and 50 to the Chicago Motor Coach Company. The other 25 will be delivered to the Fifth Avenue Coach Company of New York. Work on the units is already under way in Pontiac.

The Diesel engine is a six-cylinder, two-cycle unit, built by the Diesel Engine Division of General Motors in Detroit.

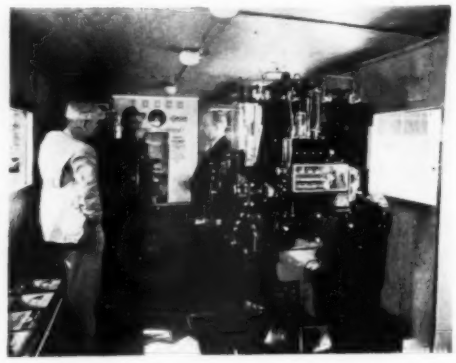
The automatic transmission is an exclusive product of the Yellow Truck and Coach Manufacturing Company.

TRAVELLING DIESEL DISPLAY

THE Diesel Engine Exhibit merchandising display on wheels is proving very popular as a sales promotor. The unit, a specially built Fruehauf trailer mounted on a D-300 tractor, was designed primarily for the company's participation in a series of Diesel short courses conducted by the mechanical engineering departments of Michigan State College, State University of Ohio, and universities of Illinois, Minnesota and Wisconsin. During these short courses the trailer transported all the material used by Geo. Penkoff, service manager, San Francisco branch, the lecturer. The truck was driven from school to school by Phil Foster of the Chicago motor truck branch.

The equipment was rearranged at the close of the university tour for an educational and merchandising project, to be displayed in front of a dealer's store. The trailer is equipped with an electric hoist and the units mounted on casters so that all equipment can be displayed on a showroom floor or in a lecture room.

The side door is divided, part opening upward and part down, to form a convenient platform for the exit from the display.



Looking forward showing the Tocco unit, photographic exhibits, and the special units. Literature tables are conveniently located.

The trailer is wired for 110-volt electricity, which will be obtained locally, so all equipment in the trailer can be operated and well lighted. The equipment includes a cut-out Diesel engine, injection nozzle display, Tocco crankshaft hardening display, several displays, a Diesel "flash" or flame machine illustrating how Diesel fuel burns. Sound motion picture equipment, curtains and other necessary equipment for demonstration lectures are included.

The Diesel Engine Exhibit is an attractive, attention-getting unit even when closed ready for transit.

The Diesel Engine Exhibit is now on a tour of several Central and Northwestern District branches. Each branch arranges five or more showings for the week it has the tailer. These showing include schools and colleges as well as customer and prospect showings. Advance publicity announces the Diesel exhibit.

DIESEL PROGRESS

INDEX OF ADVERTISERS

NEW DIESEL ENGINE CATALOG

JUST off the press, DIESEL ENGINE CATALOG, Volume III is now ready to mail. 288 pages, size 10¼ in. by 13½ in., 704 illustrations. Edited by B. J. Von Bongart, aviation section by Paul H. Wilkinson. Price $3.00 postpaid.

Ninety-seven different models of Diesel engines are described in full detail in this new book, forty more than in Volume II published last year.

This new book on Diesel engines is entirely different from any other book published on the subject. It describes and illustrates in intimate detail ALL engines now available on the American market, as such it is tremendously useful from many different angles.

B. J. Von Bongart, author of the new book "Diesel Engines," and technical editor of DIESEL PROGRESS, one of the most experienced and best known engineers in the Diesel industry, has described in intimate detail these ninety-seven Diesel engines. In this book he goes into the matter of individual design, discusses the features of design of each engine in clear cut, thoroughly understandable manner and makes it possible for the reader to grasp readily and quickly the difference between the various makes and types of engines now available on the market. He makes it possible to select from these ninety-seven different models the one engine fitted to the job in mind.

Beautifully illustrated in color, with sectional drawings visualizing with complete clarity the design features of each engine, this new book

brings you under one cover a marvelously clear picture of the engines now available. Right up to the minute, as modern as tomorrow, printed on a big page size (10¼ in. by 13½ in.) to make the illustrations readable, this new book is indispensable to the Consulting Engineer, Diesel Salesman, prospective Diesel engine buyer – yet the price is but $3.00 postpaid.

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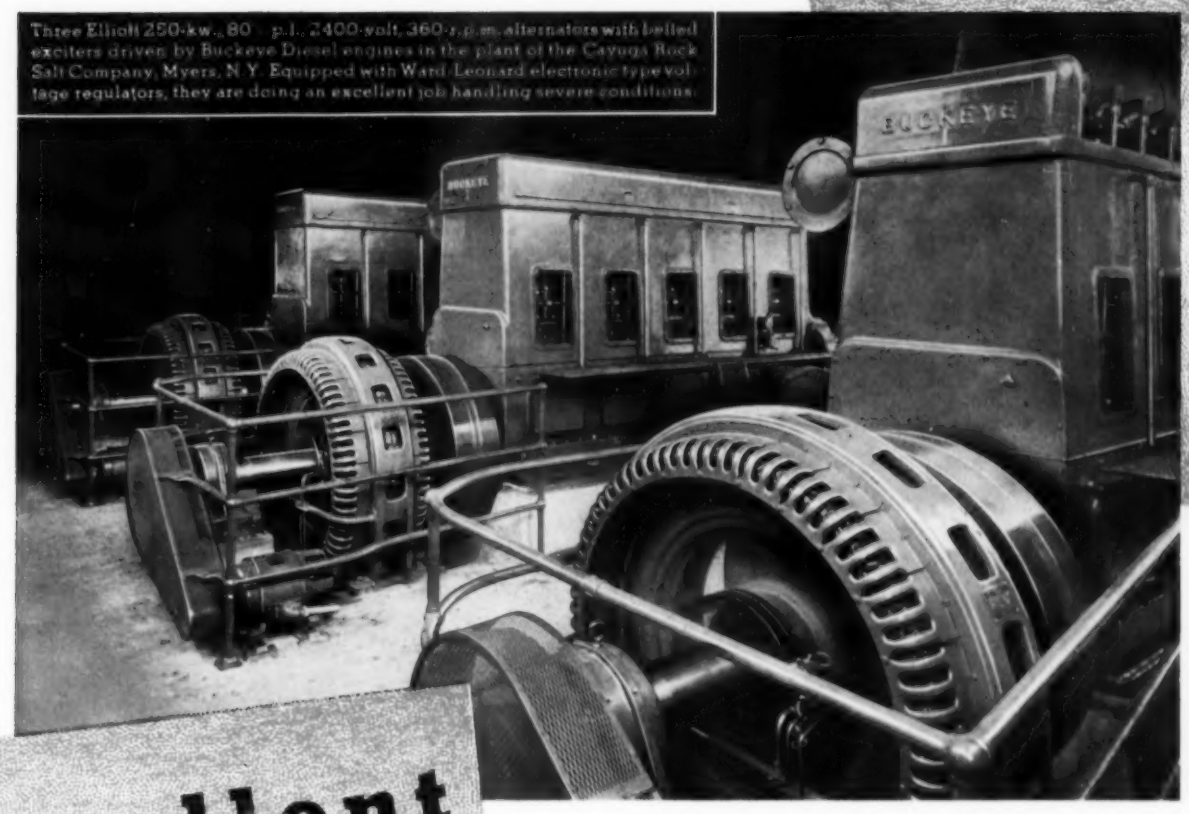
DIESEL ENGINES DESCRIBED

Alco Four-Cycle Stationary
Alco Locomotive Type
Alco-Sulzer Types
Alfa Romeo
Allis-Chalmers Oil Engines
Atlas Imperial
Ball-Muncie
Bristol "Phoenix" Diesel
Buckeye
Buda-Lanova
Busch-Sulzer Bros. 2-cycle and 4-cycle
Caterpillar Industrial and Marine Engines
Chicago Pneumatic
Clerget Aviation Diesel
Coatalen Aviation Diesel
Cooper-Bessemer
Covic
Cummins
De La Vergne
Deutz Diesel Engines
Enterprise
Fairbanks-Morse
General Motors
Gray Marine Diesels
Guiberson Aviation Diesel
Hall-Scott "Chieftain"
Hamilton-M.A.N. Double Acting
Hercules Automotive Diesels
Hill Diesels Models A, B, and C
Ingersoll Rand Type "S"
International Harvester
Junkers Jumo 205 Diesel
Kahlenberg
B. M. W. Lanova
Lister Small Stationary Diesels
Lorimer
Murphy MD Series
Napier Culverin Diesel
Nordberg 2-cycle and 4-cycle
Northeastern Diesel Engines
Ruston-Hornsby – Horizontals
Sterling Crankless
Stover Single Cylinder Diesel
Superior
Thornburg High-Speed Diesel
Venn-Severin
Victor Horizontal Type
Waukesha
Weber Vertical and Horizontal Types
Western – Type DS
Witte
Worthington

Copies of the DIESEL ENGINE CATALOG, Volume III, may be obtained from DIESEL PROGRESS, 2 West 45th Street, New York, N. Y. Price $3.00 postpaid.

• SEALED PROPOSALS will be opened by the Superintendent of Lighthouses, Room 532, Federal Building, Milwaukee, Wis., 11 A.M., September 15, 1938, for sale of one twin screw steel steam Lighthouse tender, dimension 169 ft. long, 30 ft. beam, gross tonnage 680, net 386 tons, displacement 700 tons. Information upon application.



Three Elliott 250-kw., 80 - p.f., 2400-volt, 360-r.p.m. alternators with belted exciters driven by Buckeye Diesel engines in the plant of the Cayuga Rock Salt Company, Myers, N. Y. Equipped with Ward Leonard electronic type voltage regulators, they are doing an excellent job handling severe conditions.

Excellent generator performance speeds up salt mine

Power for the salt mine of the Cayuga Rock Salt Co., Myers, N. Y., is furnished by these three Elliott 250-kw. generators, operating in parallel. There is one big 500-hp. wound-rotor induction motor which drives the skip hoist, and when it comes on the line it tends to cause plenty of disturbance. But the generators, engines, and voltage regulators were designed for this condition, and the regulation and quick voltage response obtained is very pleasing. In fact, the operation of the skip hoist has been speeded up since the Diesel engine-generators have been installed.

Elliott generators are always designed and built, not only for fine performance, but with all special conditions of the installation well in mind.

Your Elliott generator is made for *your* plant.

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A DIESEL THAT can TAKE IT

2 YEARS DRIVING A GENERATOR.

2 YEARS DRIVING A 10" DREDGE PUMP.

1½ YEARS DRIVING THE "FALCON".

Here's proof that Cooper-Bessemer Diesels fit into any power picture! Purchased by Shell Producers Company in 1933, the engine that has this record is now serving their tug "Falcon" in making her regular tow . . . 200,000 gallons of gasoline from Jacksonville to Sanford, Florida (147 nautical miles) in 26 hours. The Type EP Diesel develops 150 hp economically day after day.

No matter which Type of Cooper-Bessemer Diesel engine your need calls for, you'll find that engine easy to handle, economical to fuel and maintain, and fully capable of delivering the needed horsepower at all times. Modern design, finest materials and advanced engineering assure such performance and long life.

Shell Producers Company tug "Falcon", length 45' beam 11', draft 5', and powered with a Type EP, 6-cylinder Diesel engine developing 150 hp at 500 rpm. The "Falcon" is one of the most powerful tugs for her size, in the U. S.

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